WAVETEK®

OPERATOR'S MANUAL

Model 680

Multi-Function System

MAINFRAME

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680 Manual Set

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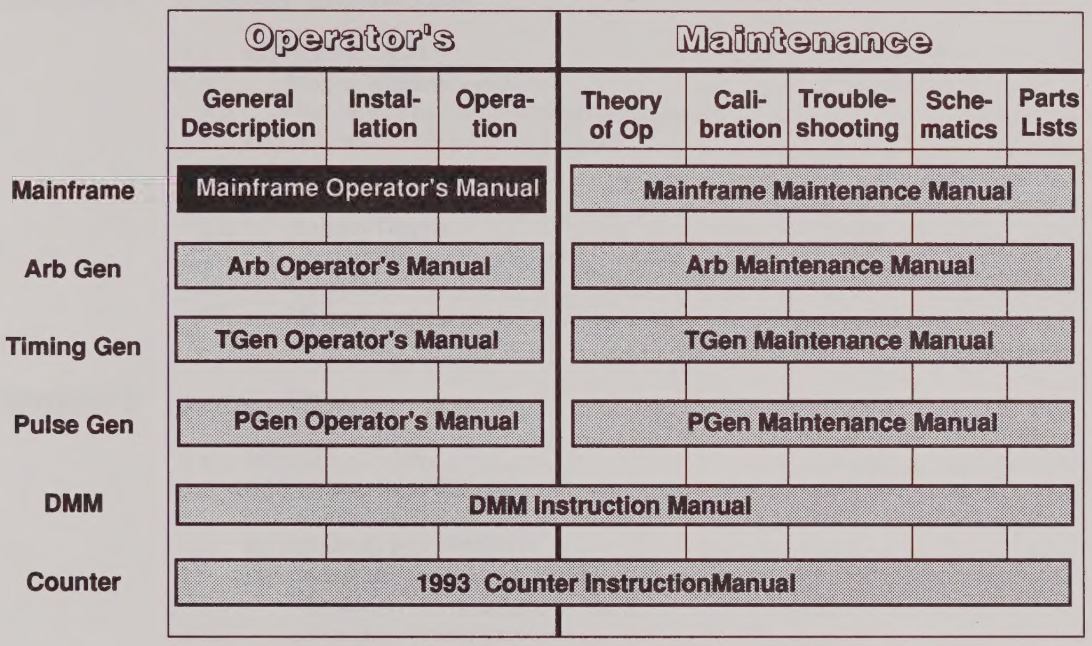
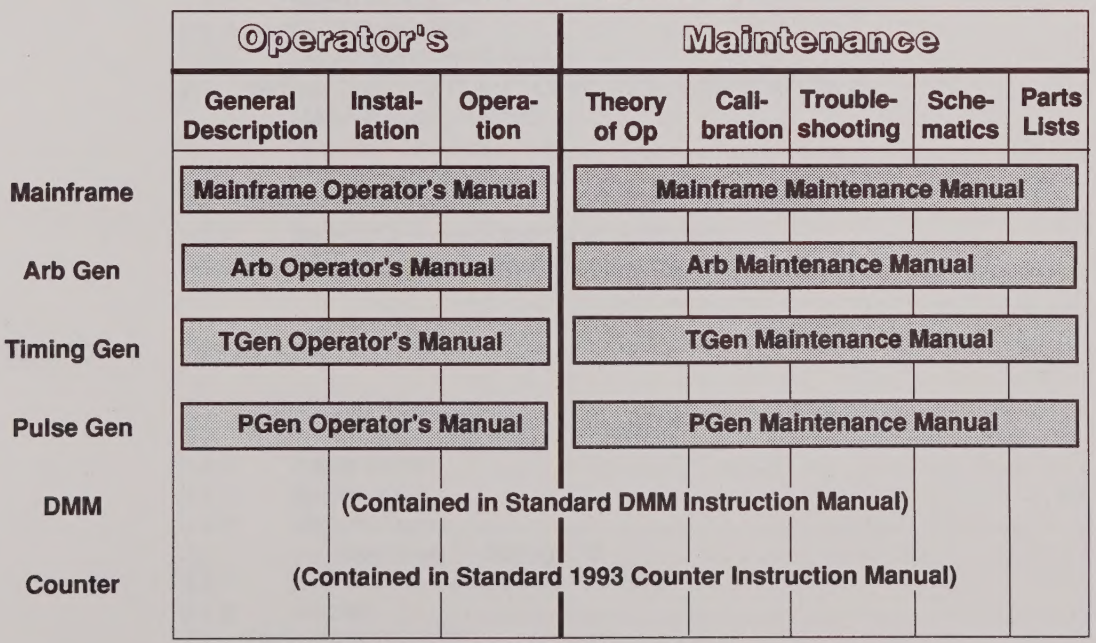


680 MATE Manuals



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SAFETY FIRST

PROTECT YOURSELF. Follow these precautions:

- Don't touch the outputs of the instrument or any exposed test wiring carrying the output signals. This instrument can generate hazardous voltages and currents.
- Don't bypass the power cord's ground lead with two-wire extension cords or plug adaptors.
- Don't disconnect the green and yellow safety-earth-ground wire that connects the ground lug of the power receptacle to the chassis ground terminal (marked with ⏚ or ⚠).
- Don't hold your eyes extremely close to an rf output for a long time. The normally nonhazardous low-power rf energy generated by the instrument could possibly cause eye injury.
- Don't plug in the power cord until directed to by the installation instructions.
- Don't repair the instrument unless you are a qualified electronics technician and know how to work with hazardous voltages.
- Pay attention to the **WARNING** statements. They point out situations that can cause injury or death.
- Pay attention to the CAUTION statements. They point out situations that can cause equipment damage.

SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The Wavetek model 680 multifunction system, shown in figure 1-1, is a modular, bench or rack mounted test instrument.

The model 680's hardware consists of:

1. Plug-in modular "instrument on a card" hardware (seen shaded in figure 1-1) and,
2. Permanent system mainframe hardware which controls and supports the modules.

1.1.1 Plug-In Module Hardware

Eight channels or positions are available for the option modules. Currently a 20 MHz Arbitrary Waveform Generator, a 100 MHz Timing Generator, a 1.3 GHz Time Interval Frequency Counter, and a 6-1/2 Digit Digital Multimeter (DMM) are available.

1.1.2 Permanent System Mainframe Hardware

Mainframe support resources for the modules consist of a switching power supply module, front panel, VME

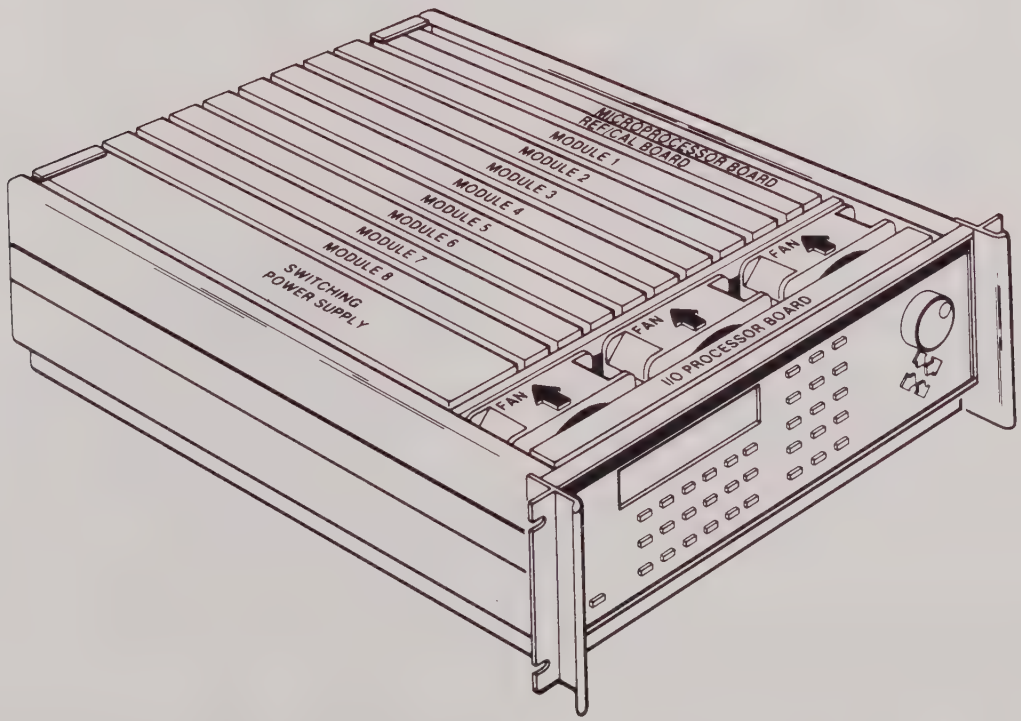


Figure 1-1. The Model 680 Multifunction System Mainframe

microprocessor board, reference/calibrator board, input/output (I/O) processor board and main interconnect board (motherboard).

Figure 1-2 illustrates the interconnection of the 680 system. The instrumentation controller is IEEE-488.2 compatible; it initializes and loads the 680 with test setups which automatically evaluate equipment under test.

Figure 1-3 illustrates the 680 block diagram. As previously described, the permanent system mainframe hardware supports and interfaces with the modules used or needed for a wide range of signal and timing applications.

The **I/O Processor Board**, containing a 6803 microprocessor, enables the user to communicate with the 680 either from the keyboard (manual operation) or from the IEEE-488 bus (remote operation). The programming commands from either source are routed to the **VME Microprocessor Board,** which contains a 68000 microprocessor, that analyzes these commands to call-up menus or execute command setups. The I/O processor board uses a liquid crystal display (LCD) to give a visual indication of front panel operation and permits the user to view menus, which define labels for function keys, current instrument parameters and warning responses of keyboard error or erroneous operation.

The **Reference/Calibrator** (ref/cal) **board**, as its name implies, provides certain reference resource signals and voltages which are used by the permanent mainframe

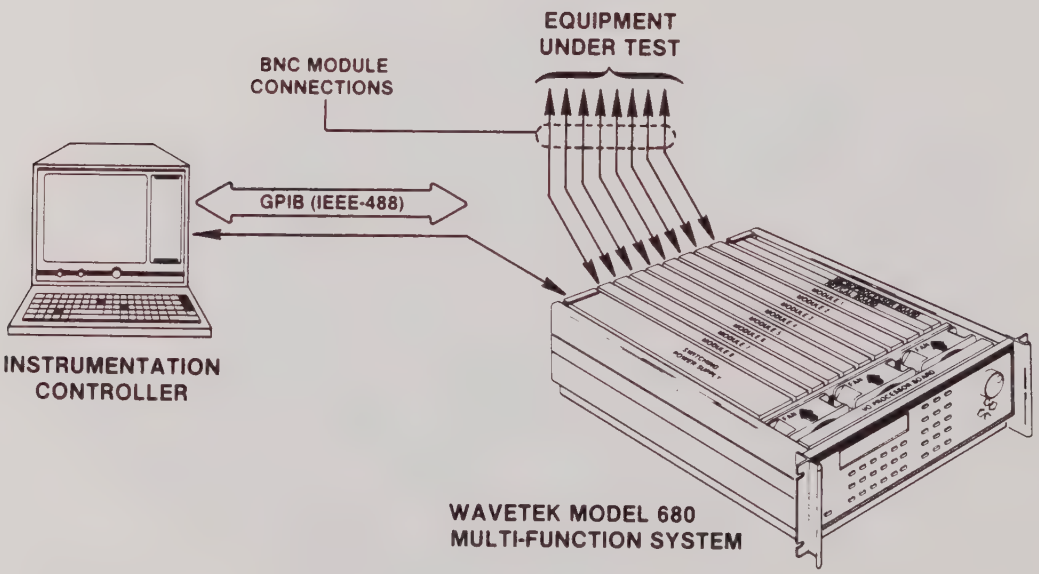


Figure 1-2. Model 680 System Interconnection

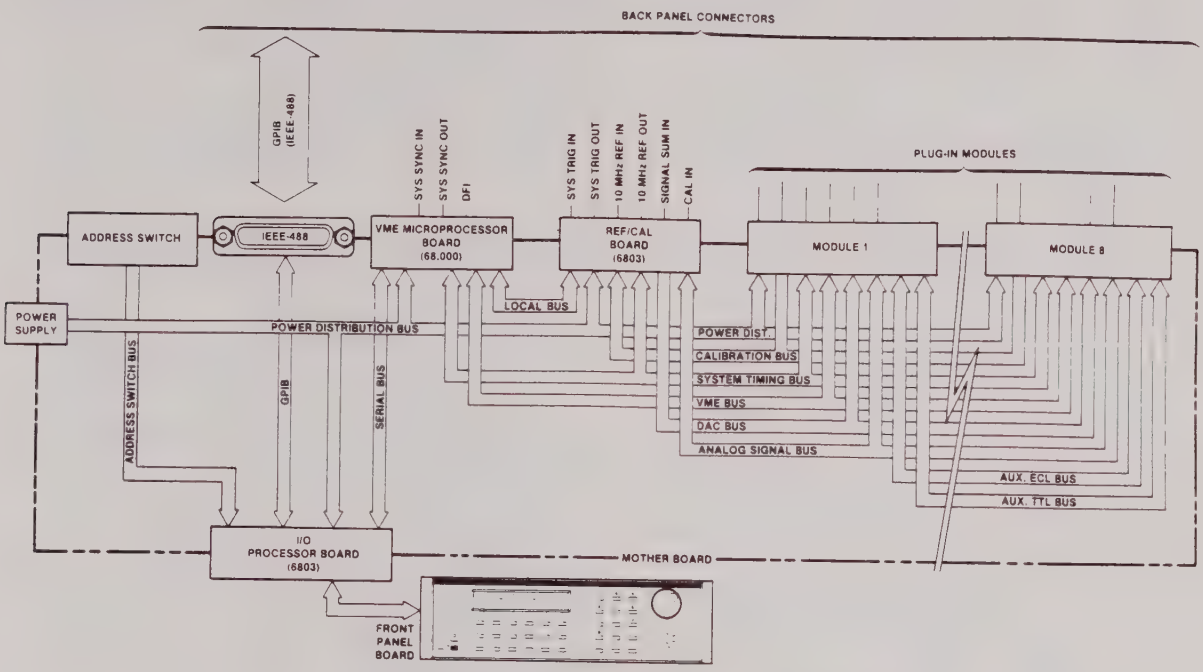


Figure 1-3. Model 680 System Architecture

system hardware to calibrate the installed source modules. (The 6 -1/2 DMM and the 1.3 GHz Counter do not utilize these resources.) In addition, the ref/cal board is controlled by a 6803 microprocessor which interfaces with the microprocessor board through a local bus. The specific resources provided by the ref/cal board are:

1. A DVM (3 digit) used for calibration and diagnostics of the modules.
2. A frequency counter (100 MHz) which is also used for calibration and diagnostics of the modules.
3. A system trigger source which can be, through choice, either internally generated or externally supplied. The external trigger is definable as far as slope (either positive or negative edge causes trigger), level (what amplitude causes the trigger), event (a selectable number of events causes trigger) and delay (after a certain amount of time causes a trigger).
4. A 10 MHz oscillator reference frequency which can be selected as being either internally generated or externally supplied. This signal provides a clock frequency for logic circuits and also appears at the back panel as a 10 MHz 50Ω TTL output.
5. A 100 MHz oscillator provides a frequency reference for the plugin modules.
6. A highly accurate and stable 10V and 10V reference voltage for the permanent mainframe and plug-in modules.
7. A 16 bit output sampled digital to analog converter (DAC) that provides high resolution control voltages to the modules for the control of module parameters such as amplitude and offset.

The eight layer **Main Interconnect Board (Motherboard)** not only provides all the necessary interfacing between the mainframe system resources and plug-in modules, but also supports communication paths between the modules themselves. A listing of these internal interfacing busses and their function is given below:

1. GPIB Bus — This bus is connected between the IEEE-488 connector on the rear panel and the I/O processor board and provides the communication path between the 680 and the external instrumentation controller.
2. VME Bus — Used by the microprocessor board to input and output command data to the option modules, this bus is basically an extension of the 68000 microprocessor.

3. Local Bus — This bus provides a communication link between the microprocessor board and the ref/cal board.
4. System Timing Bus — This bus entails three timing signals:
   a. A 10 mHz clock for use by logic circuitry throughout the 680.
   b. A system synchronization (SSYNC) line which can provide the necessary timing signals to ensure all modules or instruments are in sync with one another.
   c. A system trigger (STRIG) line which initiates certain events to occur when the trigger mode is selected. This signal can be either internally generated or externally supplied.
5. Calibration Bus — This ref/cal input only bus is used to supply a sampling of voltages and frequencies from each of the plug-in modules for automatic calibration and built-in test (BIT) or self diagnostics.
6. DAC Bus — This ref/cal output bus consists of 16 high resolution analog control lines which drive the modules to control the instruments amplitude, offset or other variable programmed parameters.
7. Analog Signal Bus — This 7 line bus providing the distribution of analog signals, is detailed as follows:
   a. One line, titled "ANASUM", is common to the ref/cal board and all modules and is used to provide analog signal summing between any and all modules.
   b. Three signal lines labelled sig. 4, 5 and 6 are common only to the modules.
   c. Sig. 1, 2 and 3 are used for the pulse amplitude modulation (PAM) function and are connected between set pairs of modules, i.e., channel plug-in module slots 1 and 2, 3 and 4, 5 and 6, or 7 and 8.

The power supply provides supply voltages for the entire 680 via the power distribution bus. Voltages provided are: +5V, -5V, +15V, -5V, +24V, -24V, +5V isolated and a +24V unregulated supply.

1.3 MODEL 680 SYSTEM MAINFRAME

1.3 SPECIFICATIONS

1.3.1 Outputs

System Sync Output and System Trigger Output: Source selected by Slave/Independent keys.
Signal Level: 0.2 to 1.0 V into 50Ω typ.
Transition Time: <10 ns.
Output Impedance: 50Ω.

10 MHz Reference Output: 0.2 to 2.4V into 50Ω (TTL for >10kΩ).
Transition Time: <10 ns into 50Ω.
Output Impedance: 50Ω.

DFI Output: (Discrete Fault Indicator.) Relay contact closure to indicate fault condition for power off, microprocessor failure or over-temperature.

1.3.2 Inputs

System Sync Input: Selected by Slave mode TTL levels required.
Input Impedance: >1kΩ.
Bandwidth: >20 MHz.
System Trigger Input: A signal of 1 Vp-p to 10 Vp-p will trigger the system.
Frequency: <20 MHz for Normal trigger and <5 MHz for Delayed and Event trigger.
Transition Time: <50 ns.
Minimum Pulse Width Requirement: 25 ns.
Impedance: >1kΩ.

10 MHz Reference Input: 1 Vp-p min to 10 Vp-p.
Bandwidth: >10 MHz ±5%.
Input Impedance: >1kΩ.

Analog Sum Bus Input
Max Input Voltage: ±5 Vp-p.
Bandwidth: >10 MHz.
Impedance: 50Ω.

Calibration Input: Used to calibrate internal DVM. ±4 Vdc ±0.1 mV.

1.3.3 System Trigger

External Trigger
Modes: Normal, Time Delay, Event Delay.
Delay
Range: 100 ns to 10 s.
Resolution: 100 ns.
Accuracy: ±(1% + 30 ns).
Event Delay: 2 to $1 \quad 10^7$ events with selectable slope.

Internal Trigger
Frequency Range: 0.01 Hz to 10MHz.
Resolution: 4 digits.
Accuracy: 0.05%.

1.3.4 Internal Frequency Reference

10 MHz Reference
Accuracy: ±1 ppm, 15° to 35°C.
Stability: ±1 ppm/year (typ).

1.3.5 General

Stored Settings: 99 stored settings are provided by the chassis. These are allocated as needed between the chassis and installed modules.

GPIB Programming: The software interface uses a subset of the IEEE-488.2 Draft Standard, "Codes, Formats, Protocols and Common Commands for use with ANSI/IEEE Std 488.1-198x. IEEE Standard Digital Interface for Programmable Instrumentation," version dated 27 March 1987.

IEEE-488 Subsets: SH1, AH1, TE6, LE4, SR1, RL1, PP0, DC1, DT1 and E1.

Environment

Specifications Apply: 25° ± 10°C after 30 min warm-up, except stability specifications apply after a 60 min warm-up and ambient temperature within ±3°C.

Operating Range: 0° to 50°C.

Relative Humidity: 95% non-condensing at 25°C.

Altitude: 10,000 ft.

Storage: –40° to 75°C, 40,000 ft.

Dimensions: 44.5 cm (17.5 in.) wide, 17.78 cm (7 in.) high, 54.6 cm (21.5in.) deep. Supplied with rack mount adapters

Weight: 17.3 kg (38 lb) net; 20.9 kg (46 lb) shipping.

Power: 90 to 126.5 Vac, 200 to 250 Vac, 48 to 66 Hz. <50 watts (chassis only), <500 watts with 8 modules installed.

Extender Cards: Three 96 pin cards are required per module.

1.3.6 Modules

Model 680-00: Blank Module

A Blank Module must be ordered to fill each unused slot. They provide continuity for the interrupt daisy chain and for proper cooling.

Model 680-01: 20 MHz Arbitrary Waveform Generator

12 bit vertical resolution. Sine, square, and trigger waveforms contained in ROM. 20V peak-to-peak output.

Model 680-02: 100 MHz Pulse/Timing Generator

5ppm frequency accuracy. 0.1% accuracy and 10 digits or 1 ns of resolution for delay and width. Up to 30V peak-to-peak output.

Model 680-05: Digital Multimeter

Datron Model 1365. 6-1/2 digit, 0.006% basic accuracy. 2/4 wire resistance measurement modes.

Model 680-06: 160 MHz Frequency/Time Interval Counter

Racal Dana Model 1993. 1 ns single shot time interval measurement.

1.3.7 Option

010: MATE-CIIL Interface

SECTION 2
INSTALLATION

2.1 INTRODUCTION

This section provides receiving, inspection, installation, and checkout procedures for the Model 680. Installation instructions for individual function modules are detailed in their respective manuals.

2.2 RECEIVING INSPECTION

Check the shipment at the time of delivery for missing boxes and inspect each box for damage. Describe any box damage and list any shortages on the delivery invoice.

2.3 UNPACKING

1. **Unpack the boxes.** Unpack the boxes in a clean and dry environment. Save all the packing materials in case the instrument(s) have to be returned for repair.
2. **Inspect the equipment for damage.** Inspect the equipment carefully for any signs of mechanical damage regardless of the condition of the shipping boxes.
3. **If necessary, file a damage claim.** In the case of mechanical damage, call the shipper immediately and start the claim process.
4. **Call Wavetek.** Call Wavetek's Customer Service Department (619-279-2200) to inform them that the shipment arrived damaged. Please be prepared to provide a detailed damage report.

2.4 RETURNING EQUIPMENT

Follow these steps when you return equipment to Wavetek:

1. **Save the packing material.** Always return equipment in its original packing material and boxes. If you use inadequate material, you'll have to pay to repair any shipping damage as carriers won't pay claims on incorrectly packed equipment.
2. **Call Wavetek Customer Service and ask for a return authorization.** Wavetek's Customer Service representative (619-279-2200) will ask for your name, telephone number, company name, equipment type, and a description of the problem.
3. **Pack and ship the equipment.**

2.5 MECHANICAL INSTALLATION

The following paragraphs contain information on mechanically installing the Model 680 on a bench top or in a standard 19-inch rack.

2.5.1 Installation Considerations

1. **Mounting**

   The Model 680 can be used as a conventional stand-alone bench test instrument or it can be rack mounted (refer to figure 2-1) in a standard 7 inch by 19 inch panel opening. Rack mounting requires either chassis rails that are mounted inside the rack or rack slides that are fastened to the left and right side of the Model 680 using pre-drilled holes. The chassis rails can be purchased or fabricated locally. The Wavetek part number for the rack slides is 1000-00-0358. These are 22 inch rack slides that will provide up to 24 inches of travel. The rack slides can be installed in either a 22 or 24 inch cabinet (24inch requires adapters).

2. **Cooling**

   The Model 680 uses perforations in the top and bottom covers as intakes for cooling air. At least 1/2 inch of space around the perforations is required for cooling to enter the instrument; at least three inches of space behind the instrument is required for exhaust air to leave the instrument. When the Model 680 is rack mounted, the rack must provide adequate cooling air around the instrument and a means for the instrument to exhaust the warm air from the rear panel.

2.5.2 Installation Procedure

Install the Model 680 using the procedures listed below. Adapt the steps as necessary to suit your requirements (steps 3 and 5 are optional depending on the installation requirements). The paragraphs given at the end of each step contain detailed information on performing the step.

1. Verify that the ac power and fuse configurations are correct (refer to paragraph 2.6.1).
2. Verify that all of the cables and accessories required are properly installed and/or connected (refer to paragraph 2.6.1, and 2.6.2).

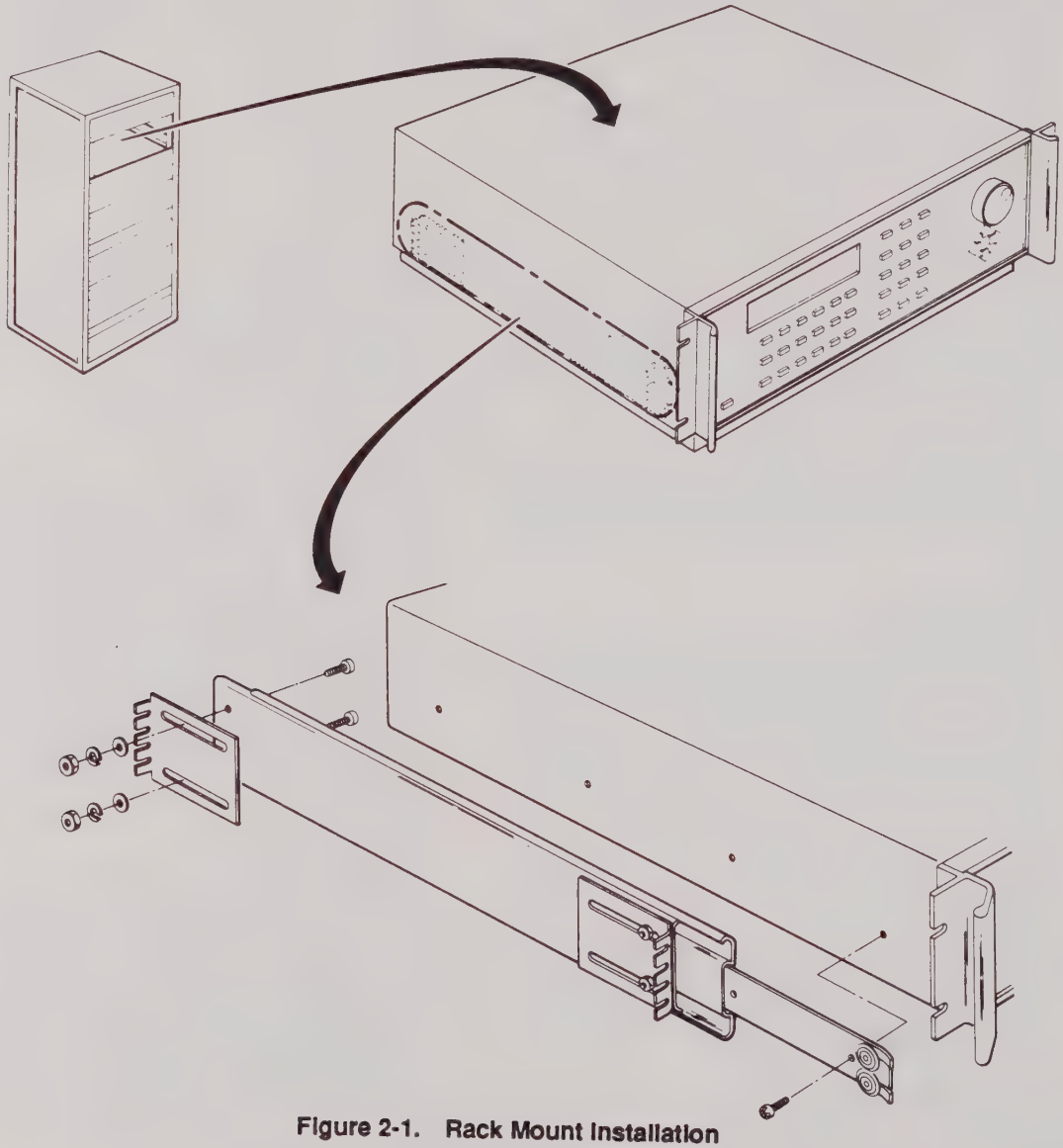


Figure 2-1. Rack Mount Installation

3. Set the GPIB address. (Refer to paragraph 2.6.4.)
4. Verify that the instrument passed the Initial Checkout and Operation Verification Procedure in Section 2.7.
5. Install the 680 in a rack mount (refer to paragraph 2.5.1).

2.6 ELECTRICAL INSTALLATION

The following paragraphs contain information on electrically connecting the Model 680 to the ac power source and to the signal processing and generating instruments.

2.6.1 Power Verification and Connection

Use figure 2-2 and the following procedure to verify and, if necessary, configure the Model 680 to accept the available line voltage.

1. Place the Model 680 front panel **Power** switch to the "**Standby**" position and the rear panel power switch to the ""0" (OFF) position (4). Remove the power cord from the Model 680 rear panel power input connector (5).
2. If the correct voltage rating (refer to table 2-1) is not displayed on the voltage selector switch (1), use a

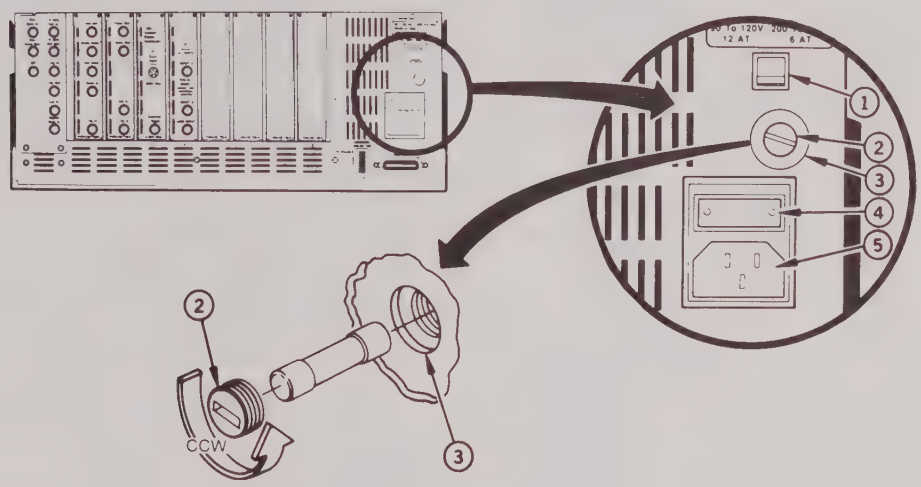


Figure 2-2. Voltage Selector Switch and Fuse Assembly

straight slot screwdriver to set the switch to the correct voltage (115 V or 230 V).

3. Use a straight slot screwdriver to unscrew (CCW) the slotted cap (2) from the fuse holder assembly (3).
4. Remove the cap and fuse and check the fuse current rating. The label on the 680 rear panel calls out the correct rating.
5. If correct, reinstall the fuse and slotted cap in the fuseholder. If not correct, replace the fuse with one of the correct rating and then install the fuse and slotted cap in the fuseholder.
6. Connect the ac power cord to the power connector on the instrument rear panel (5).
7. Connect the power cord to the line power source.
8. Place the rear panel Power Switch to the ""I" (ON) position (4).

2.6.2 Signal Connection

All signal connectors (and power connectors) are located on the rear panel. The signal connectors fall into two groups: the "system" connectors located on the left side of the rear panel and the "instrument module" connectors that are located on the applicable module. The only exception is the GPIB connector; it is located on the lower right side of the rear panel. Use RG-58/U or equivalent 50Ω coaxial cable terminated with BNC connectors to distribute all of the signals (except for the GPIB signals). For applications where different source/load impedances are used, select the appropriate cables. Some modules will have their own cables provided for special connectors.

To determine the exact signal connection requirements for the planned installation, refer to Section 2.8 of this manual which contains the rear panel "system" connector descriptions and a brief overview of the instrument module connectors. Each of the "instrument modules" is described in more detail in a separate manual delivered with the purchase of the particular "instrument module".

2.6.3 GPIB Connection

When connected to a General Purpose Instrumentation Bus (GPIB), an external instrumentation controller can control the operation of the Model 680. Connect to this bus with the standard IEEE-488 connector located on the rear panel.

Standard pre-wired GPIB bus cables are available from Wavetek in one meter (p/n 6001-50-0006) and two me-

ter (p/n 6001-50-0007) lengths and are used to connect the Model 680, and other instruments on the bus, to an instrumentation controller. Table 2-1 gives the signal carried by each pin of the GPIB connector (Amphenol 57-10240 or equivalent).

Table 2-1. GPIB Connector Pin Functions

Pin	Signal	Pin	Signal
1	DIO1	13	DIO5
2	DIO2	14	DIO6
3	DIO3	15	DIO7
4	DIO4	16	DIO8
5	EOI	17	REN
6	DAV	18	Signal Ground
7	NRFD	19	Signal Ground
8	NDAC	20	Signal Ground
9	IFC	21	Signal Ground
10	SRQ	22	Signal Ground
11	ATN	23	Signal Ground
12	Chassis Ground	24	Signal Ground

2.6.4 Setting the GPIB Address

Standard GPIB instrument controllers require that each controlled instrument on the GPIB bus have a unique address assigned. The Model 680 supports address selections in the range of 0 to 30.

When first powered on, the 680 sets its GPIB address to the value set by the rear panel GPIB **Address Selector** switches (see figure 2-3). Changing the setting of the selector switches changes the GPIB address as does entering a new value for the GPIB address via the front panel Utility/GPIB menu. To see the value of the power-up address on the front panel display:

1. Push the front panel Power switch to **On**.
2. Press the **System** Utility/GPIB switch.
3. Press the **GPIB** F5 softkey under the display.
4. Press the **adrs** F4 softkey under the display. The display will show the present value of the 680 GPIB address.

Set the model 680 GPIB power-up address with the **Address Selector** DIP switches on the rear panel (see figure 2-3). Use table 2-2 to find the combinations of switch closures that correspond to the desired GPIB address. It is necessary to repeat step four above each time the rear panel Address Selector DIP switches are changed to have the display show the most recent address change.

The model 680 GPIB address can be changed from the front panel if the Front Panel Enable switch shown in figure 2-3 is the "1" position. To change the GPIB address from the front panel:

1. Push the front panel Power switch to **On**.
2. Press the **System** Utility/GPIB switch.
3. Press the **GPIB** F5 softkey under the display.
4. Press the adrs F4 softkey under the display. The display will show the present value of the 680 GPIB address.
5. Rotate the Cursor knob counterclockwise or clockwise to decrement or increment the address. The new GPIB address is the value displayed. This can also be achieved by entering value and then Execute.

Table 2-2. GPIB Address Switch Settings

GPIB Address	16	8	4	2	1
00	1	1	1	1	1
01	1	1	1	1	0
02	1	1	1	0	1
03	1	1	1	0	0
04	1	1	0	1	1
05	1	1	0	1	0
06	1	1	0	0	1
07	1	1	0	0	0
08	1	0	1	1	1
09	1	0	1	1	0
10	1	0	1	0	1
11	1	0	1	0	0
12	1	0	0	1	1
13	1	0	0	1	0
14	1	0	0	0	1
15	1	0	0	0	0
16	0	1	1	1	1
17	0	1	1	1	0
18	0	1	1	0	1
19	0	1	1	0	0
20	0	1	0	1	1
21	0	1	0	1	0
22	0	1	0	0	1
23	0	1	0	0	0
24	0	0	1	1	1
25	0	0	1	1	0
26	0	0	1	0	1
27	0	0	1	0	0
28	0	0	0	1	1
29	0	0	0	1	0
30	0	0	0	0	1

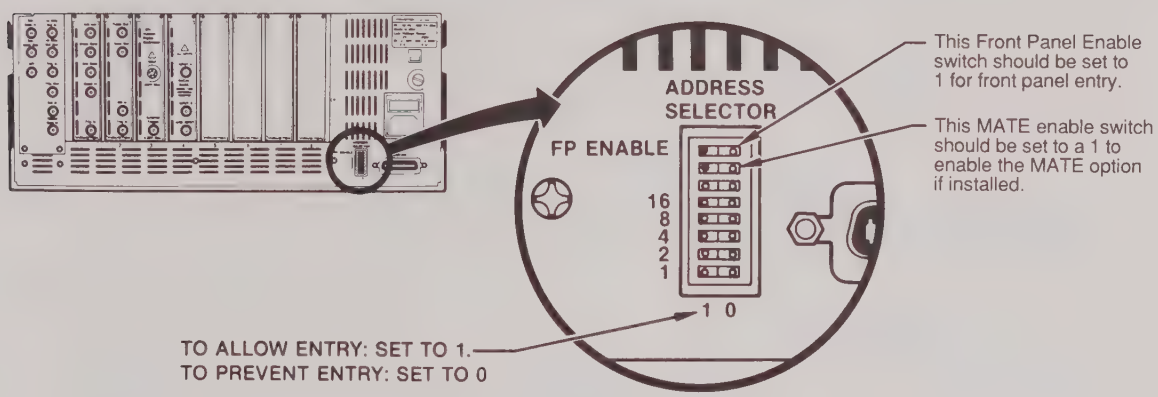


Figure 2-3. Rear Panel GPIB Address DIP Switch

2.7 CONFIDENCE TEST AND OPERATION FAMILIARITY PROCEDURE — MAINFRAME CHASSIS

The Confidence Test and Operation Familiarity Procedure given in table 2-4 tests the operation of the Model 680 mainframe chassis components. (A similar test for checking the condition of the "instrument modules" can be found in the installation section of the module manual provided with the module. This procedure can be used for:

1. **Receiving Checkout.** The incoming inspection department should carry out this procedure to establish that the equipment has not been damaged in transit.
2. **New Operator Training.** Operators not familiar with this piece of equipment can use this procedure to better understand the operation of the controls.

2.7.1 Required Test Equipment

Table 2-3 lists the required test equipment for this procedure.

2.7.2 Checkout Verification Record

Table 2-5 following the checkout procedure is an operation test record that can be used to keep a permanent record of the test results.

Table 2-3. Required Test Equipment

Equipment	Qty	Specifications
Oscilloscope	1	Dual Channel. Vert Sens: 10 mV to 5V/DIV. Horiz Swp: 5 nS to 1 Sec/DIV. Input Imp: ≥1 MΩ or 50Ω. Bandwidth: ≥100 MHz, ≥300 MHz preferred.
Terminations	3	BNC feedthrough. 5W (40W optional). 50Ω impedance (75 or 93Ωopt.)
Coaxial Cables	3	One meter lengths. BNC male on both ends. RG-58/U type, 50 Ω (75 or 93Ω opt.).
Signal Generator	1	10 MHz minimum. Output: 50Ω, 5 Vpp minimum Output Connection: BNC. Required Function: Square Wave.
Frequency Counter	1	10 MHz minimum.

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis

Step	Action	Test Set-ups and Action Responses
1	**Power-up Test**	
1-1	Perform the Power verification and connection steps in paragraph 2.6.1.	
1-2	Press the front panel **Power** switch to **On**. Unit has failed test if mes sage at right does not appear.	sys ----- WAVETEK Model 680 ----- Ver X.X.X
1-3	Run a Global Autocal. (Refer to section 3.12 for details).	
2	**Beeper Test**	
2-1	Press the following front panel keys in order.	
2-2	**Utility GPIB**	sys ------ utility / gpib ------ frtpnl time temp diag gpib
2-3	**frtpnl** — **F1**	sys ---- front panel ---- beep view lite
2-4	**beep** — **F1**	sys beeper on OFF Front panel beeper can be turned on or off from this menu. The selected menu will be in caps.
3	**Display View Angle Test** The display viewing angle can be adjusted to compensate for equipment height. The adjustment range is between 0 and 45.	Each change in the setting of the viewing angle should result in a change in the display viewing angle (contrast).

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses
3-1	Press the following front panel keys in order.	
3-2	**Utility/GPIB**	sys --------- utility / gpib --------- FRTPNL time temp diag gpib
3-3	**FRTPNL — F1**	sys --- front panel --- BEEP view lite
3-4	**view F2**	viewing angle: 0 sys --- front panel --- beep VIEW lite
3-5	Rotate **Cursor** knob clockwise	viewing angle: 45 sys --- front panel --- beep VIEW lite
3-6	Press the down **Cursor** arrow twice.	viewing angle: 43 sys --- front panel --- beep VIEW lite
3-7	Enter value with keyboard. Press **3**, **0**, **Execute**.	viewing angle: 30 sys --- front panel --- beep VIEW lite
4	**Back-light Test**	
4-1	Press the following keys in order.	
4-2	**Utility GPIB**	sys ------ utility / gpib ------ FRTPNL time temp diag gpib
4-3	**FRTPNL — F1**	viewing angle: 30 sys --- front panel --- beep VIEW lite

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses
4-4	**lite — F3**	sys backlight on off Pressing either selection executes the selection and returns to the previous menu shown below. sys --- front panel --- beep view LITE
5	**Time Display Test**	
5-1	Press the keys that follow:	
5-2	**Utility/GPIB**	sys --------- utility / gpib --------- FRTPNL time temp diag gpib
5-3	**time — F2**	sys -- time -- - elapsed - set disp start disp stat
5-4	**time-disp F2**	sys current time display on off
5-5	**on — F1** Might not be preset to correct time from factory	sys 9:43:07 24 JAN 87 -- time -- - elapsed - set DISP start disp stat
5-6	**Utility/GPIB**	sys 9:46:58 24 JAN 87 --------- utility / gpib --------- frtpnl TIME temp diag gpib
5-7	**TIME F2**	sys 9:43:07 24 JAN 87 -- time -- - elapsed - set DISP start disp stat

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

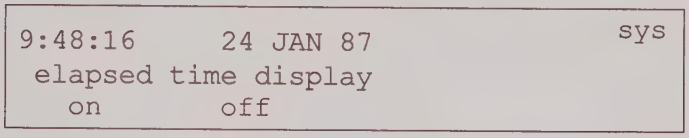
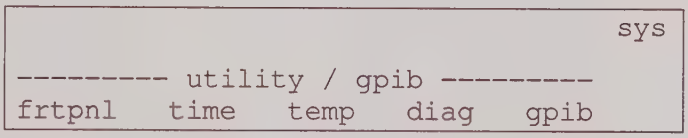
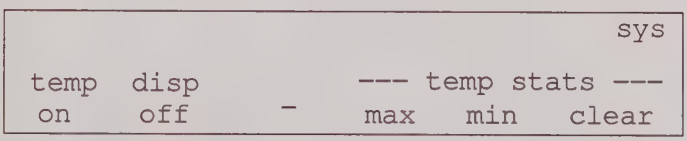
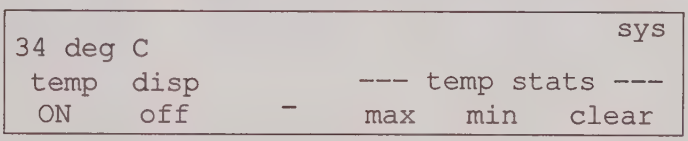
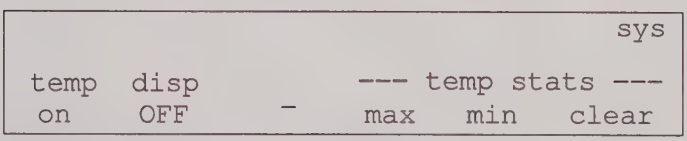
Step	Action	Test Set-ups and Action Responses
5-8	**elapsed — disp** F4	
5-9	**on** F1 Turn elapsed time off at this point, by pressing "utility", "time", "elapsed disp" and "off".	 Shows the amount of elapsed time since the last time the start button was selected.
6	**Temperature Sensor Test**	
6-1	Press the following keys:	
6-2	Utility/GPIB	
6-3	**temp** — F3	
6-4	**on** — F1	
6-5	**off** — F2	

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

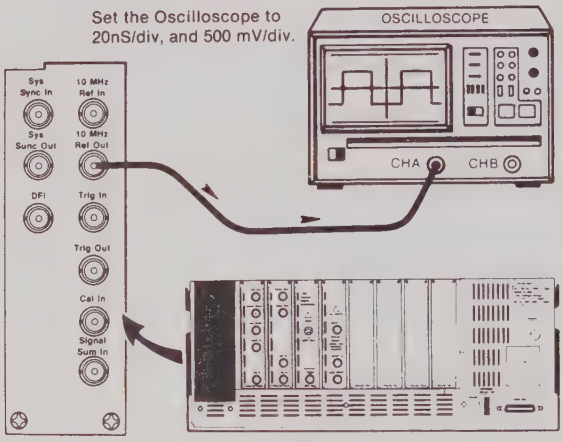
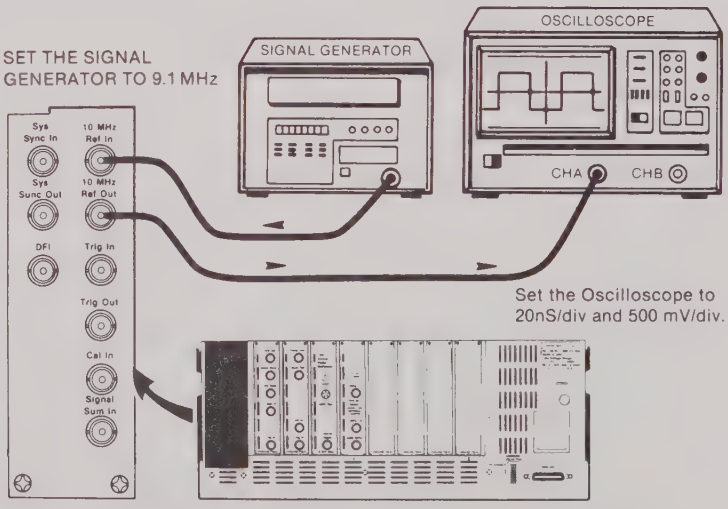
Step	Action	Test Set-ups and Action Responses
7	**10 MHz Reference Test**	
7-1	Connect the 680 rear panel **10 MHz Ref Out** output to the oscilloscope Channel A input as shown at right.	
7-2	If the oscilloscope Channel A input is not terminated with a 50Ω load, observe on the oscilloscope a 10 MHz, 5 Vp-p square wave with a rise/fall time of <10 ns.	
7-3	If the oscilloscope Channel A input is terminated with a 50Ω load, observe on the oscillo scope a 10 MHz, 2.5 Vp-p square wave with a rise/fall time of <10 ns.	
7-4	Set the signal generator to 9.1 MHz and connect its out-put to the **10 MHz Ref** In BNC on the 680 back panel. Con-nect the oscilloscope to monitor the **10 MHz Ref Out** of the 680.	
7-5	Press:	
7-6	**System** — System	sys ------ system menu ------ -reference- trig slave indep int ext

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses

7-7	Select internal reference(F4), and observe the 10 MHz signal on the oscilloscope.	`Internal frequency reference set sys`
		`------ system menu ------ -reference-`
		`trig slave indep int ext`

7-8	Try and select external reference (F5). Error message will appear.	`sys`
		`External reference out of range`
		`------ system menu ------ -reference-`
		`trig slave indep int ext`

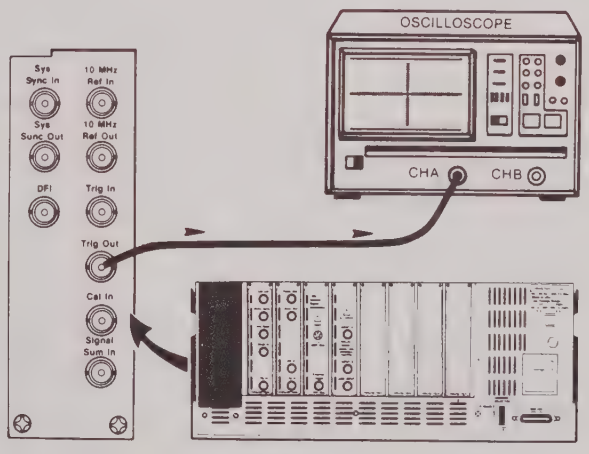
8	**System Trigger Test**	
8-1	Connect the **Trig Out** BNC on the 680 rear panel to the oscilloscope Channel A input as shown at right.	

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

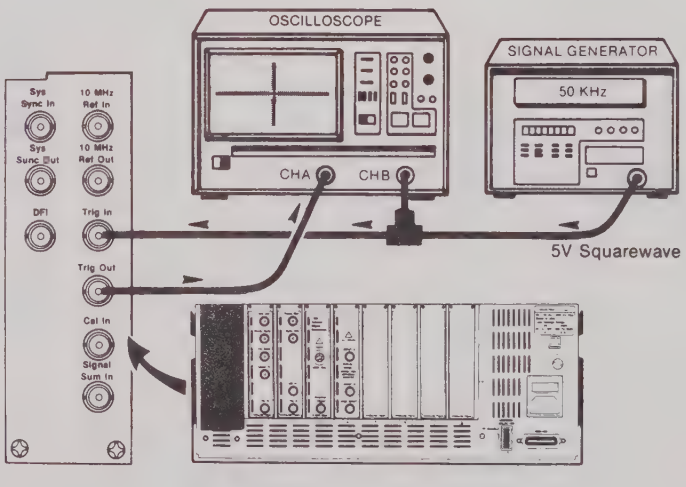
Step	Action	Test Set-ups and Action Responses
8-2	Press the following keys:	
8-3	**trig** F1	sys - trigger mode - off intern extern
8-4	**intern** F2	trigger frequency: 10.00 kHz sys - trigger mode - off INTERN extern
8-5	Press the numeric keys: 1 , 0 . 0 , Exponent , 3 , Execute	trigger frequency: 100.0 kHz sys - trigger mode - off INTERN extern Oscilloscope shows 100 kHz square wave.
8-6	Set the signal generator to 50 kHz and feed this frequency into the **Trig In** input BNC on the rear panel of the 680 and also monitor this square wave on one channel of the oscilloscope. Connect the **Trig Out** output BNC of the 680 to the other input channel of the oscilloscope. See this test setup shown at the right. Signal gen amplitude to 0 to 5V squarewave.	
8-7	Press:	sys - external trigger mode - - slope - normal delay events level pos neg
8-8	**extern** F3	

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses
8-9	**normal** F1	sys – external trigger mode – – slope – NORMAL delay events level pos neg
8-10	**pos** F5	sys – external trigger mode – – slope – normal delay events level POS neg
8-11	**neg** F6	sys – external trigger mode – – slope – normal delay events level pos NEG
		Note that Channel A and Channel B of oscilloscope are 180 out of phase.
8-12	**pos** F5	sys – external trigger mode – – slope – normal delay events level POS neg
8-13	**events** F3	trigger delay events: 2 sys – external trigger mode – – slope – normal delay EVENTS level pos neg
8-14	**enter 4,** Execute	trigger delay events: 4 sys – external trigger mode – – slope – normal delay EVENTS level POS neg
		Note that the frequency of the system trigger is one-fourth that of the signal generator frequency on the oscilloscope.
8-15	Press:	sys
8-16	System	------ system ------ – reference – TRIG slave indep int EXT
		sys
8-17	**TRIG —** F1	– trigger mode – off intern EXTERN

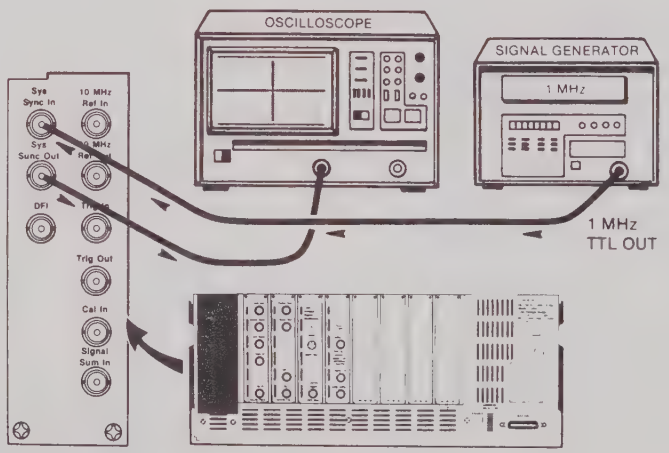
Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses

8-18	**EXTERN** — F3	`trigger delay events: 4 sys`
		`- external trigger mode - - slope -`
		`normal delay EVENTS level pos neg`

8-19	**delay** — F2	`trigger delay events: 100nS sys`
		`- external trigger mode - - slope -`
		`normal DELAY events level pos neg`

8-20	5, Exponent, 6, =, Execute
	
	Note: trig delay is only allowable while input signal is High. This delay cannot be less than input width.
		`trigger delay time: 5.0 uS sys`
		`- external trigger mode - - slope -`
		`normal delay EVENTS level pos neg`
		
		Verify on the oscilloscope a 5 µsec delay between the Sys Trig In input signal leading edge and the 680 Sys Trig Out output pulse.

9	**System Sync Test**	
9-1	Set the signal generator output to a 1 MHz square wave. Connect to the 680 **Sys Sync In** input on the rear panel. Connect the 680 **Sys Sync Out** to the oscilloscope. The test setup is shown at right.	

9-2
9-3
	Press:
	
	System
		`sys`
		`------ system ------ - reference -`
		`TRIG slave indep int ext`

Table 2-4. Confidence Test and Operation Familiarity Procedure — Mainframe Chassis (Continued)

Step	Action	Test Set-ups and Action Responses
9-4	**slave** F2	sys ------ system ------ - reference - trig SLAVE indep int ext The 680 is now configured as a slave to the external **Sys Sync In** input from the signal generator. This signal is mirrored to the 680 System Sync (SSYNC) bus and also appears at the 680 **Sys Sync Out** BNC and consequently on the oscilloscope.
9-5	Press **indep** F3.	sys ------ system ------ - reference - trig slave INDEP int ext Observe the absence of any signal on the oscilloscope; there is no activity on the System Sync (SSYNC) bus.
9-6	Test complete. Turn Power to **Standby**.	

Table 2-5. Mainframe Chassis Test Record

Step	Test	Test Results
1	Power-up Test	
2	Beeper Test	
3	Display Viewing Angle Test	
4	Back-light Test	
5	Time Display Test	
6	Temperature Sensor Test	
7	10 MHz Reference Test	
8	System Trigger Test	
9	System Sync Test	

2.8 THE 680 REAR PANEL

2.8.1 System Connector and Switch Functions

All connections are located on the rear panel. Figure 2-4 shows the 680 System Mainframe rear panel with typical modules installed. Table 2-6 describes the function of each mainframe connection. (Refer to the appendices for module descriptions.)

2.8.2 System Connector Electrical Specifications

Refer to table 2-7 before making any connections to the 680. Do not exceed the specifications indicated.

CAUTION
Exceeding the specifications shown in table 2-7 may cause damage to the 680.

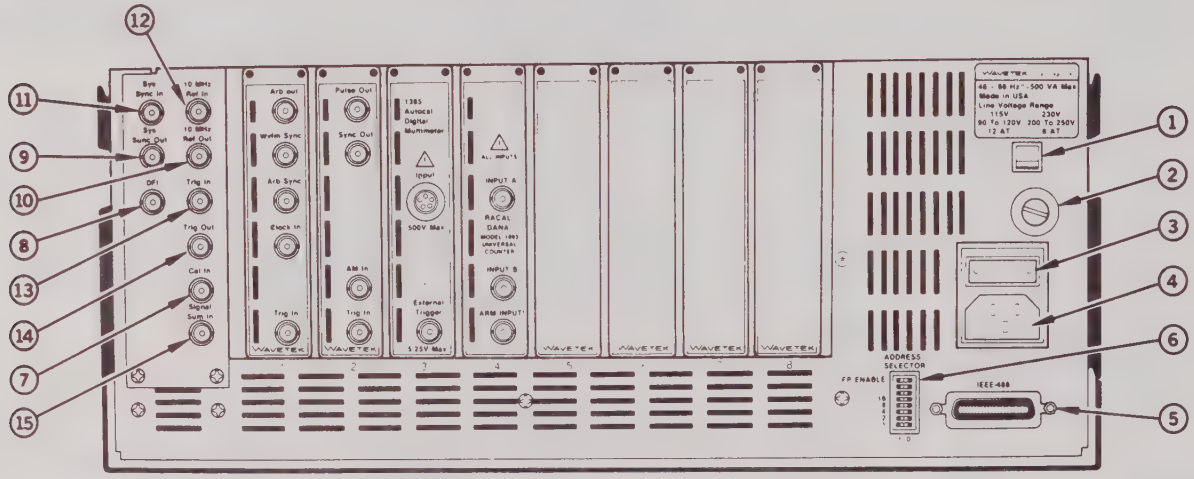


Figure 2-4. Rear Panel Switches and Connections.

Table 2-6. System Connector/Switch Functions

Label/Name	Function
(1) Selector Voltage	Allows the user to select the correct line voltage (110 Vac or 220 Vac) for the Model 680.
(2) Fuse	Limits the input current to the power supply module.
(3) Power Switch	Push the "I" side of the rocker switch to power the 680. Push the "0' side of the switch to disconnect operating power.
(4) IEC Power Connection	Input connection for the instrument line voltage (110 Vac or 220 Vac).
(5) IEEE-488	Allows connection of the external GPIB bus to this standard IEEE-488 connector.
(6) Address Selector	Sets the GPIB address for the Model 680.
(7) Cal In	Provides a reference voltage used during the manual calibration of the internal DVM.
(8) DFI	(Discrete Fault Indication) Connected to a floating set of relay contacts that open when the 680 is off, when a microprocessor failure occurs or when the 680 internal temperature reaches 75°C

Table 2-6. System Connector/Switch Functions (Continued)

Label/Name	Function
(9) Sys Sync Out	The signal appearing on the 680 System Sync bus (SSYNC) is mirrored to this output connection. Other instrumentation operation can be synchronized from this signal.
(10) 10MHz Ref Out	The 680 10 MHz internal reference frequency is mirrored to this output connection.
(11) Sys Sync In	The signal appearing at this input connection is mirrored to the 680 System Sync (SSYNC) bus.
(12) 10 MHz Ref In	An external reference 10 MHz signal appearing at this input can be selected for the 680 internal 10 MHz reference frequency.
(13) Trig In	This input provides the trigger to the 680 system Trig bus and can be used to trigger modules in the chassis.
(14) Trig Out	The System Trigger (STRIG) signal is mirrored to this output. Other equipment operation can be triggered by this 680 System Trigger.
(15) Sum Bus	This external signal input provides access to the internal analog sum bus. The summed signal will appear at the selected modules output if that modules sum feature has been selected.

Table 2-7. 680 System Electrical Connector Specifications

Connection	Type	Voltage Limits	Impedance	Protection	Other Specification
Sys Sync In	Input	0 to +1V into 1kΩ	>1kΩ	±5V	
Sys Sync Out	Output	0.2 to +1V into 50Ω	50Ω	Short Circuit	Rise/Fall time: <10 ns
DFI	Output		Contact Resistance ≤ 0.2Ω	N/A	No Fault: Open Ckt Fault: Short Ckt
10 MHz Ref Out	Output	2 TTL ≤0.2V, ≥2.4V	50Ω	Short Circuit	
10 MHz Ref In	Input				10 MHz ±5%
Trig In	Input	1 Vp-p to 20 Vp-p	>1 kΩ	±15V	Rise/Fall: < 50 ms Resolution: 0.1V Frequency: <20 MHz for normal trigger Delayed and Event: <5 MHz
Trig Out	Output	TTL	50Ω	Short	Rise/Fall time: <10 ns
Signal Sum In	Input	± 5Vp-p	>50Ω	±15V	Bandwidth: >10 MHz
Cal In	Input	±4Vdc ± 0.1 mv	>1 kΩ	±15V	

SECTION 3
OPERATION

3.1 INTRODUCTION

The front panel controls allow local operation. It should not be necessary to change any of the rear panel switch settings once the unit has been installed as in section 2.3 of this manual; use the front panel controls to manually operate the 680 after installation.

An instrumentation controller can control the 680 automatically when connected to the GPIB bus. Refer to section 3.9 for remote operation using the 680 GPIB commands.

3.2 FRONT PANEL CONTROLS OVERVIEW

The 680 front panel is shown in figure 3-1. This section briefly describes each of the controls on the front panel.

3.2.1 Power Switch

To operate the Power switch, press and release it. Table 3-1 shows what the Power switch does.

Table 3-1. Power Switch Operation

Power Switch Position	Effect	Power LED
Standby	Turns the 680 Power Supply Module outputs off; the 680 ceases to operate.	Not illuminated
On	Activates the 680 Power Supply Module; 680 operation commences.	Illuminated

3.2.2. System Keys

The System keys control the 680 System Mainframe functions; the Module keys allow option module selection and control. Table 3-2 describes each System key function and lists other sections which contain further information.

Table 3-2. 680 System Keys Description

Menu Key	Function	Further Information
Reset	The System Reset menu allows: 1. Return of the entire 680 to power-up conditions. 2. Reset of the output protection of any module that has tripped its output protection circuit.	3.8
Cal/Test	This menu allows the automatic calibration of the entire 680 System (including function modules).	3.5
Stored Settings	The System Stored Settings menu stores/recalls instrument setups making it unnecessary to manually reprogram frequently used setups of System and function module settings.	3.6
Manual Trigger (Non-Menu)	The Manual Trigger key asserts or gates the 680 System Trigger (STRIG) from the front panel.	

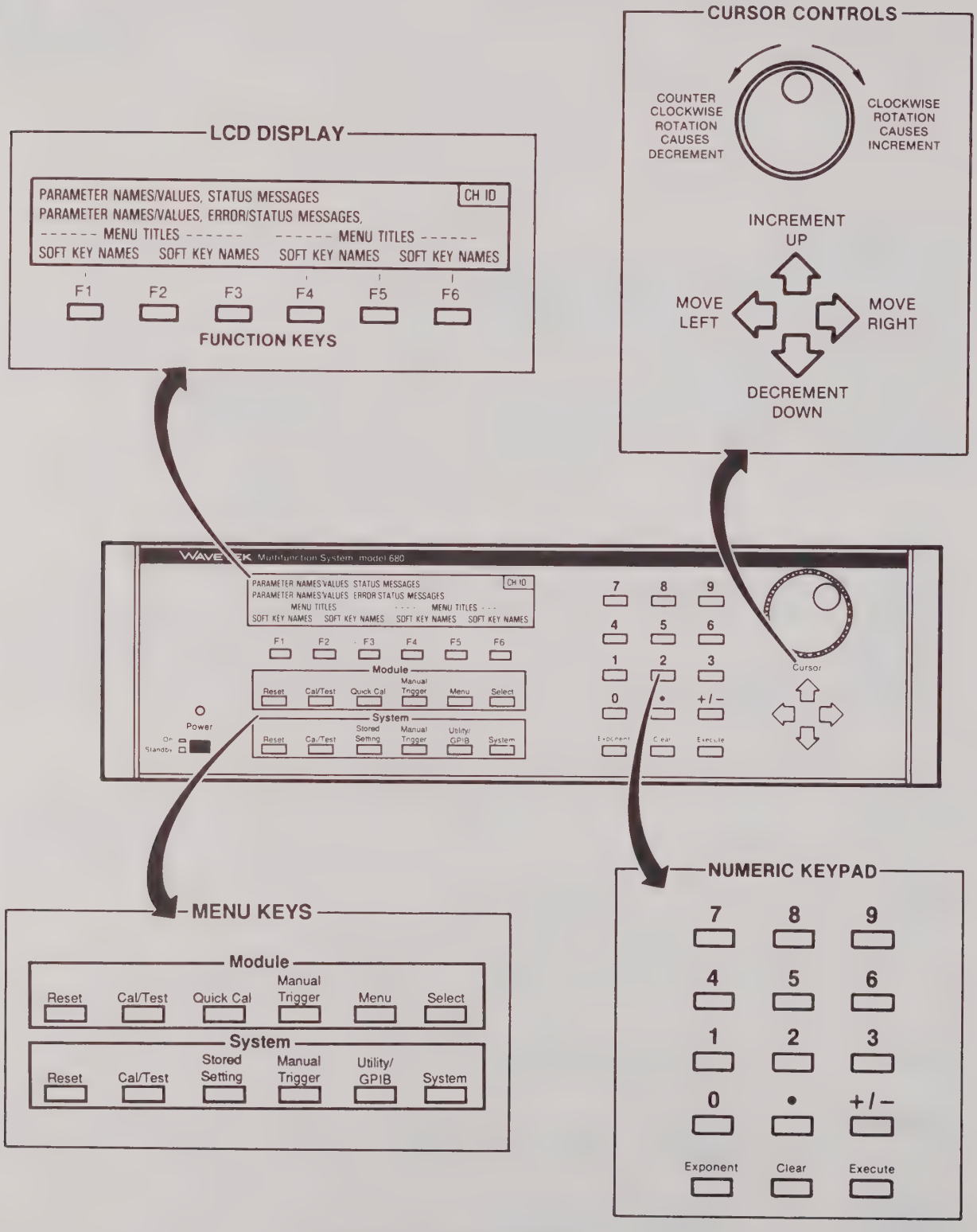


Figure 3-1. 680 Front Panel

Table 3-2. 680 System Keys Description (Continued)

Menu Key	Function	Further Information
Utility/GPIB	The Utility/GBIP menu controls the front panel beeper operation, the display viewing angle (contrast), the display backlight, the real time clock, the real time clock alarm functions, and the elapsed time, system event, and internal temperature logging functions. The Utility/GPIB menu sets the GPIB address, displays the GPIB buffer and SRQ buffer, generates service requests and returns control to local operation when being remotely controlled on the GPIB bus.	3.4
System	1. Controls the System Trigger (STRIG) source, the internal trigger frequency, the number of external triggers required for a valid System Trigger (STRIG), and the external trigger slope, threshold and delay.	3.3.1
	2. Controls the selection of the **Sys Sync In** input on the rear panel as an input to the System Sync (SSYNC) bus.	3.3.2
	3. Controls the selection of the internal or external 10 MHz reference to the 680 System Mainframe 10 MHz reference.	3.3.3

3.2.3 Module Keys

The **Module** keys allow selection and control of the function modules. Table 3-3 briefly describes each Module key; detailed descriptions of each Module key are in the function module appendices.

Table 3-3. 680 Module Keys Description

Menu Key	Function
Reset	Sets the selected function module to the powerup condition.
Cal/Test	This menu allows the automatic calibration of the module selected.
Quick Cal	This function calibrates only the current settings of the selected function module to specification. Changing any setting removes the quick calibration from that setting. (Only if implemented on module.)
Manual Trigger	This key will cause a manual trigger only on the currently selected module. Select the desired module with the Module Select key. This menu is described in this table.
Menu	This key is used to return to the top level of the currently selected function module menu.
Select	This key calls a menu that shows the location and type of all installed function modules. Pressing a numeric key that corresponds to a module that the display identifies and generates the top level menu of that module to the LCD.

3.2.4 Function Keys F1 through F6

Menus that appear on the LCD display define the **function** of keys F1 through F6; selections of 680 functions not defined by the System or Module keys are made by pressing the F1 through F6 keys that the display identifies as the desired function.

The Initial Checkout and Operation Verification Procedure in Section 2.7 shows examples of how the front panel display identifies the function of keys F1 through F6.

3.2.5 Numeric Keys and Cursor Controls

The Numeric Keypad and Cursor controls are used for the selection and entry of numeric data. These controls:

1. Simplify data selection by minimizing keystrokes.
2. Allow continuous variation of output parameters (frequency, for example) during operation.
3. Allow entry of positive or negative numbers in decimal or scientific notation.

Table 3-4. Numeric Keys and Cursor Controls Operation

Control	Operation/Function
0 through 9	The 0 through 9 keys allow the entry of fixed numbers (such as 5 or 25892 etc.). To continuously vary a parameter (e.g., change continuously from 5 to 100), use the cursor knob or cursor arrows.
. (Decimal Point)	The . (decimal) key inserts the decimal point in decimal numbers (such as 147.63).
± (Plus/Minus)	The (Plus/Minus) key changes the sign of the numeric entry.
Execute	The Execute key causes the 680 to accept numbers entered on the numeric keypad as the desired value for the parameter prompted by the display. For example, if a module output frequency is being set, the display will indicate the current value for the output frequency. The frequency can be changed by entering a new value with the numeric keypad and then by pressing Execute. Alternatively, any other key closure on the front panel can be substituted for the Execute key closure.
Clear	The Clear key erases unexecuted numbers.
Exponent	The Exponent key allows entry of exponential values. For example, 1,000,000 can be entered as 1, Exponent, 6. That is, 1,000,000 1 X 10^6.
Cursor Controls	See figure 3-1. The Cursor knob and direction arrows can vary parameter values continuously and step through numbered menu choices. For example, if a module output frequency is being set, the display will indicate the current value for the frequency. Use the Left/Right cursor arrows to position the cursor on the display under the digit in the frequency to be changed. This digit can be incremented or decremented by using the up or down cursor arrows; the entire value of the frequency can be changed by using the cursor knob. Pressing the **Execute** key or another function key to enter new values selected with the knob/cursor controls is not necessary.

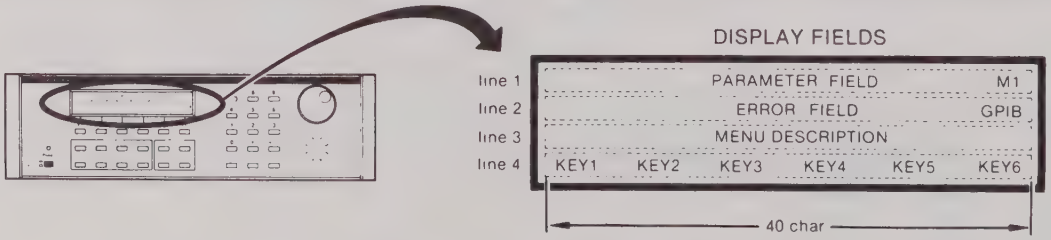


Figure 3-2. Display Fields

3.2.6 Display

The 680 uses a four line, 40 character width, backlighted liquid crystal display. The display format consists of six fields; each field is allocated for a specific information type. Figure 3-2 shows the field allocations and each field is described in the paragraphs that follow.

Parameter Field — The parameter field in line one consists of the first 36 characters. This field will indicate the parameter being displayed in lower case letters followed by a colon and one space and then the value of the parameter.

Module Field — This field is always the last four characters of line one. It consists of two spaces, a lower case "m", and the currently selected module number, if any. If the current display relates to the system instead of a modules the display will be a space followed by the lower case letters "sys".

Error Field — The error field is the first 35 characters of line two. This field is used to report errors or warnings. Error messages will remain on the display until a new display is generated. This field is also used to monitor certain functions, however, error messages will always take priority and overwrite any other use of this field.

GPIB Field — The last five characters of line two make up the GPIB display field which is used to display the status of the GPIB interface. The first two characters of the field are always spaces. The last 3 characters will contain any of the following upper case letters:

1. "R" which means remote.
2. "L" which means listen or "T" which means talk.
3. "Q" which means service request.

Menu Description Field — The third line describes the menu parameters controlled by the function keys F1 through F6 and as annotated on line four of the display.

Function Key Labels — The last line of the display provides labels for the function keys located directly below the display. Each of the front panel function keys (F1 through F6) has a matching segment of the label field linked to it. Each label field is up to 6 characters long with the exception of the F6 label which is limited to five characters. All of the label fields are separated by one space.

3.3. SYSTEM MENU KEY

The System menu key defines the front panel keys F1 through F6 to allow selection and control of the System Trigger (STRIG) source, the System Sync (SSYNC) source, and the 10 MHz reference frequency source. The System menu tree is shown in figure 3-3.

3.3.1 System Trigger Controls

The System Trigger bus connects to all of the function modules; any function module can use the System Trigger signal. The 680 System Mainframe can be programmed via the System Trigger menu to internally generate triggers of a selected frequency, or to select an external trigger signal from the rear panel **Trig In** input BNC. Further, the external trigger slope and level can be selected and be delayed by a user programmed time or number of triggers. Figure 3-4 shows functionally how the System Trigger signal is selected and the powerup trigger mode selections.

Table 3-5 describes the operation of the individual keys F1 through F6 when in the System Trigger menu.

The Initial Checkout and Operation Verification Procedure in Section 2.7 provides a step by step operators guide to the System Trigger controls.

Enter the System Menu by pressing the System System key.

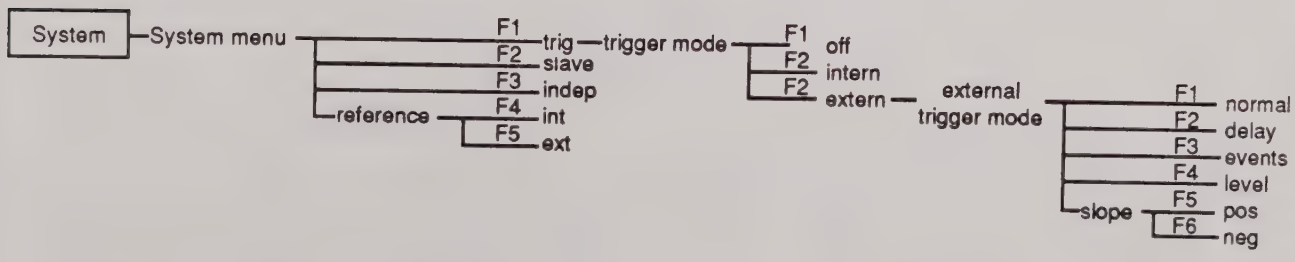


Figure 3-3. System Key Menu Tree

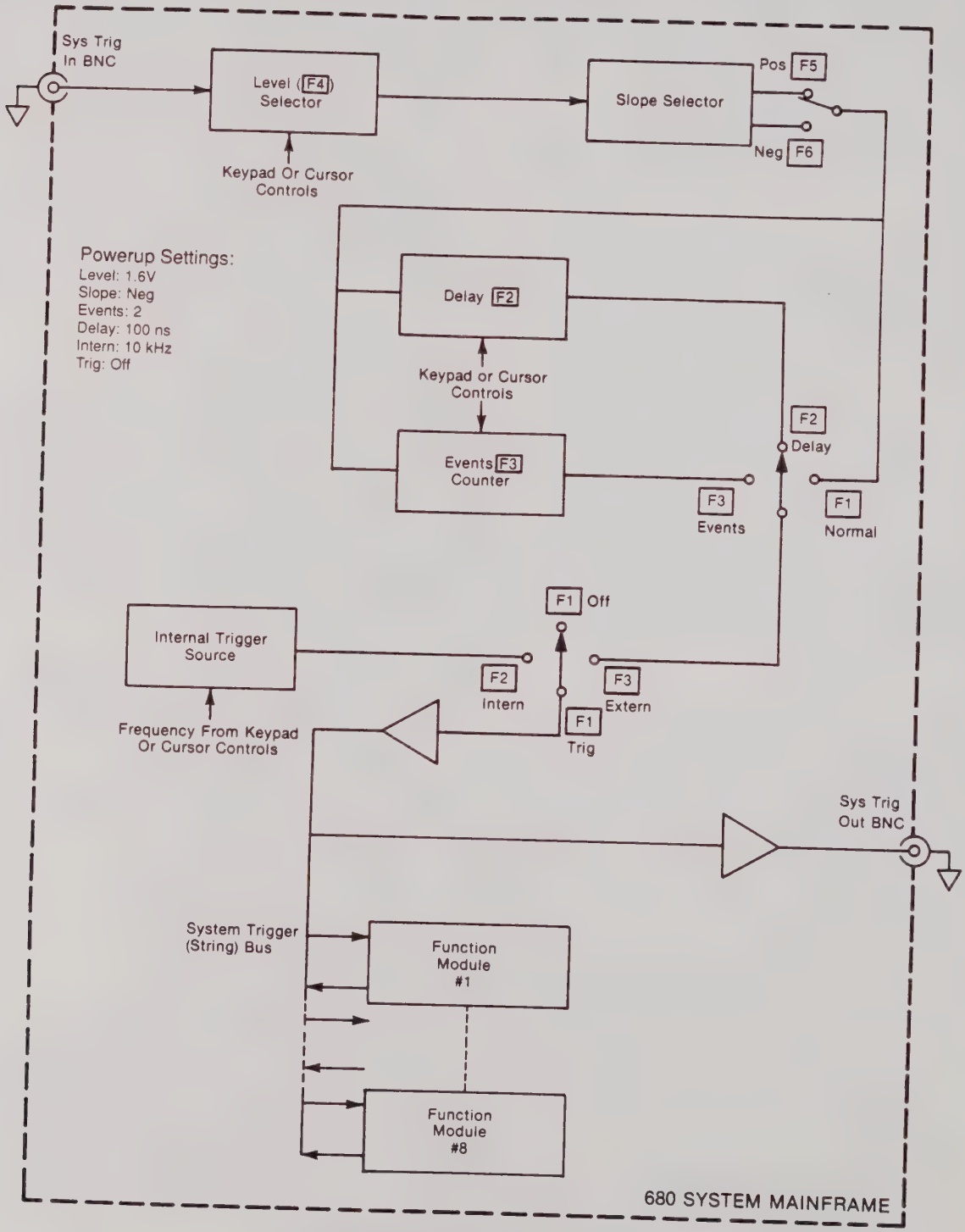


Figure 3-4. System Trigger Selection Block Diagram

Table 3-5. System Trigger Menu Selections

Top Level	Second Level	Third Level	Description
F1 trig			Calls the trigger menu. Defines the function keys F1 through F3 as follows (second level).
	F1 off		Disconnects the 680 internal trigger source and the external Trig In input from the 680 System Trigger (STRIG) bus.
	F2 intern		Connects the internal trigger source to the System Trigger (STRIG) bus and causes the current value of the internal trigger frequency to be displayed. A new value for the trigger frequency can be selected with the Numeric Keypad or the Cursor controls.
	F3 extern		Allows selection of the external trigger signal from the 680 rear panel **Trig In** input. A selection from one of the following third level function keys must be made to select the external trigger function.
		F1 normal	Connects the signal from the external **Trig In** input to the System Trigger (STRIG) bus.
		F2 delay	The active edge of the external **Trig In** input is delayed by a time shown on the display before being generated to the System Trigger (STRIG) bus. The amount of this delay can be selected by using the numeric keypad or the Cursor controls.
		F3 events	Divides the external trigger frequency from the **Trig In** input by the value shown on the display. This number of delay events can be selected with the numeric keypad or the Cursor controls.
		F4 level	Displays the voltage threshold at which the external trigger signal from the **Trig In** input becomes recognized. This level can be changed by entering a new value with the numeric keypad or the Cursor controls.
		F5 pos	The external trigger signal form the **Trig In** input becomes recognized on its rising edge when this selection is made.
		F6 neg	The external trigger signal form the **Trig In** input becomes recognized on its falling edge when this selection is made.

3.3.2 System Sync (SSYNC) Controls

The System Sync (SSYNC) bus connects to all of the function modules. Any function module configured as a slave will synchronize its operation with the signal appearing on the System Sync (SSYNC) bus; any module configured as a master will generate pulses to the System Sync (SSYNC) bus.

The 680 System mainframe can be programmed via the System Menu to disable or select the generation of the signal appearing at the external rear panel Sys Sync In input to the System Sync (SSYNC) bus. Figure 3-6 shows functionally how the System Sync (SSYNC) signal is enabled and the setting of this feature at powerup.

Table 3-6 describes the operation of the individual keys F2 and F3 when defined by the System Sync menu. After selection of the System key, the System Sync selections can be made. Refer to the System menu tree in figure 3-3.

3.3.3 10 MHz Reference Selection

The 10 MHz reference clock is connected to all of the function modules; this reference clock is used by the function modules as a timebase for operation.

The 680 System mainframe can be programmed via the System menu to select an internal 10 MHz reference or select the external reference signal appearing at the 10MHz Ref In BNC on the rear panel. Figure 3-6 shows functionally how the reference signal is selected.

Table 3-7 describes the operation of the F4 and F5 softkeys when defined by the System menu for selection of the 10 MHz reference. Additionally, section 2.7 details a step by step procedure for verification of the correct operation of this feature.

3.4 UTILITY/GPIB MENU KEY

The Utility menu allows you to control:

1. Whether or not an audible beep is generated upon the closure of a front panel key.
2. The viewing angle (contrast) and backlighting of the LCD display.
3. The time and temperature logging functions of the 680.

The Utility/GPIB menu also allows access to diagnostic functions and GPIB status information.

The Utility/GPIB menu tree is shown in figure 3-7.

Table 3-6. System Sync Menu Selections

Top Level	Second Level	Third Level	Description
F2 slave			Enables the signal from the external **Sys Sync In** input at the 680 rear panel to the System Sync (SSYNC) bus.
F3 indep			This selection disables the external **Sys Sync In** input; the 680 System Mainframe passes or generates no signals to the System Sync (SSYNC) bus.

Table 3-7. 10 MHz Reference Selections

Top Level	Second Level	Third Level	Description
F4 int			Selects the internal 10 MHz reference frequency.
F5 ext			If in tolerance, the external **10 MHz Ref In** input Bnc on the rear panel is used as a system reference. An out of tolerance external reference frequency will cause the680 to automatically select its internal reference; the appropriate error message will be displayed. Once the external frequency is accepted by the 680, it is not monitored for frequency accuracy; the accuracy may drift out of tolerance unrecognized by the 680. (Refer to the specifications in section 1 for ext. ref. frequency tolerance)

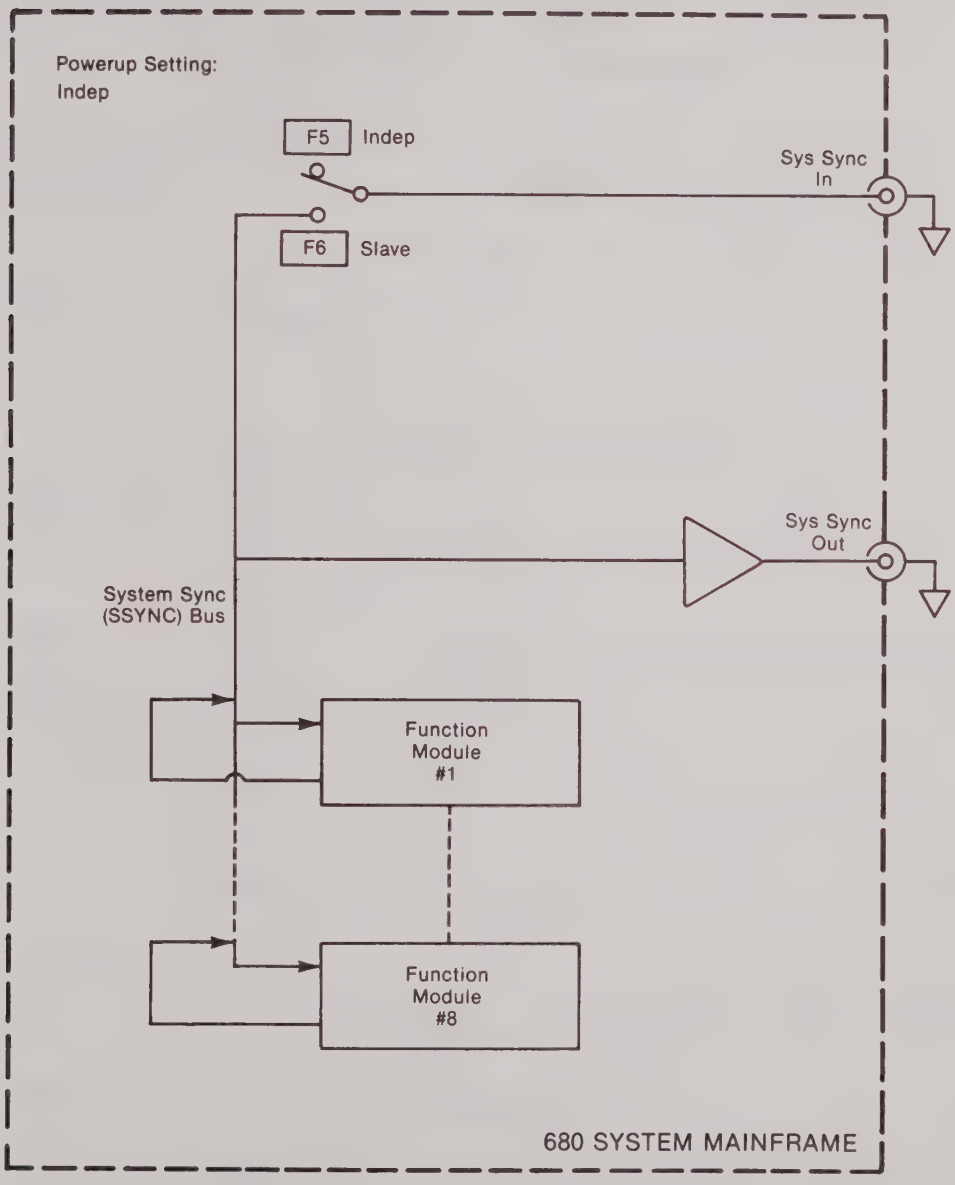


Figure 3-5. System Sync Selection Block Diagram

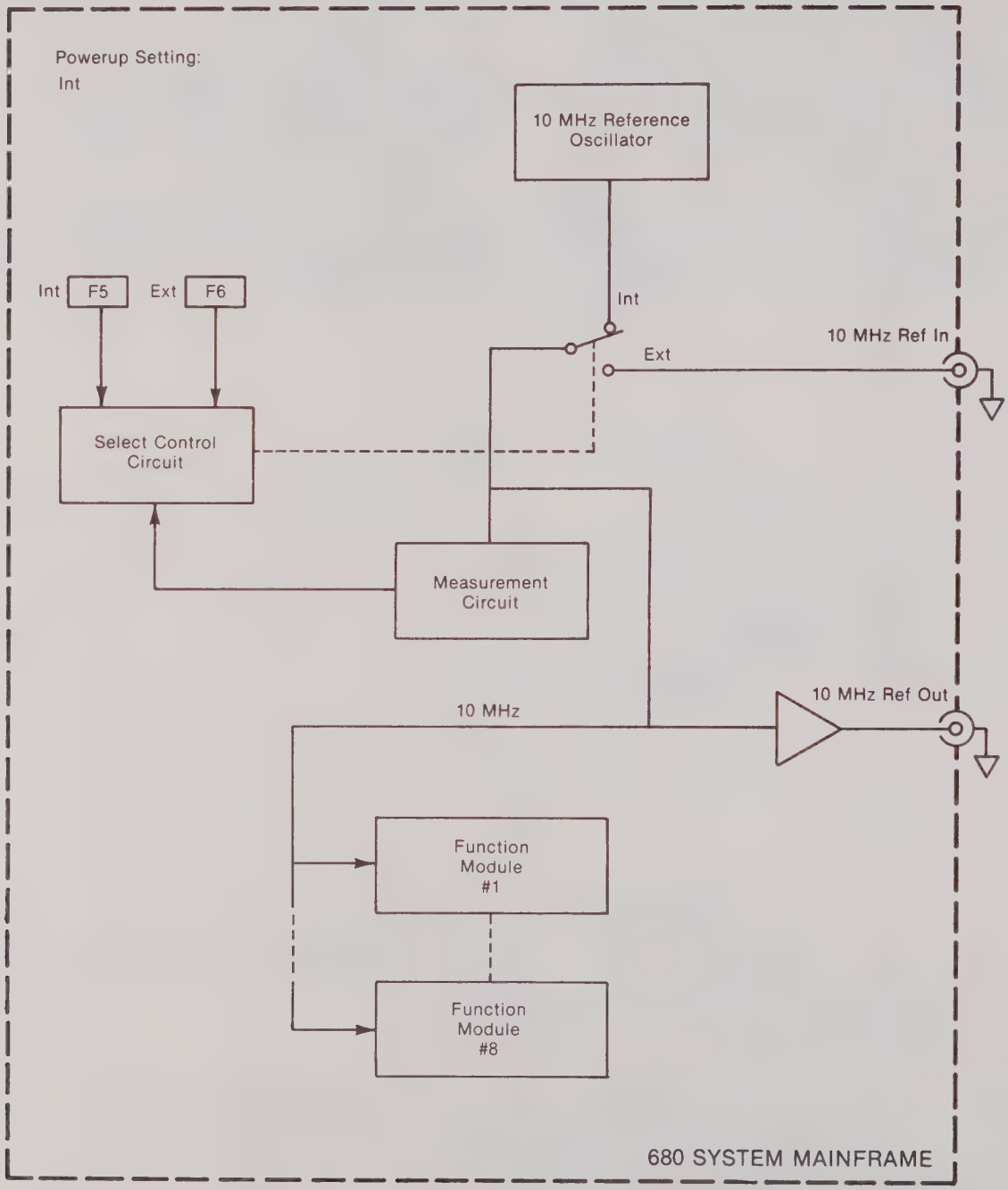


Figure 3-6. 10MHz Reference Select Block Diagram

3.4.1 Front Panel Utility Controls

This section of the Utility/GPIB menu allows control of the front panel beeper, the viewing angle (contrast), and the LCD backlight.

Table 3-8 describes the operation of the individual keys F1 through F3 when defined by the Utility/GPIB front panel menu. After selection of the System Utility/GPIB key, the front panel utilities control selections can be made.

3.4.2 Time Setting and Logging Functions

The Model 680 keeps track of:

1. The month, day and year.
2. The current time of day.
3. The value of the elapsed time counter.
4. The amount of time that the 680 has been on since the last cycle of the front panel Power Switch to On.
5. The date and time of the last complete automatic calibration.
6. The amount of elapsed time since the time was last set.

Table 3-9 describes each of the Utility/GPIB time functions and their associated keys.

Table 3-8. Utility/GPIB Front Panel Utilities

Top Level	Second Level	Third Level	Description
F1 frtpnl			Selects the front panel utility control menu.
	F1 beep		Selects control of the front panel beeper. Pressing this key will cause the display to define the function keys F1 and F2 for turning off or on the beeper as described below.
		F1 on	When the 680 is first turned on, the beeper sounds every time a front panel key is pressed. This key turns turns the beep feature on if it has been previously turned off.
		F2 off	This key turns the front panel beeper off; beeps will not sound each time a front panel key is pressed.
	F2 view		Make this selection to adjust the viewing angle (contrast) of the front panel liquid crystal display (LCD). Use the front panel knob/cursor controls to optimally adjust the viewing angle.
	F3 lite		This key allows selection of the LCD backlight. Use the F1 or F2 keys as described below.
		F1 on	This key turns on the backlight for the front panel LCD.
		F2 off	This key turns off the backlight for the front panel LCD.

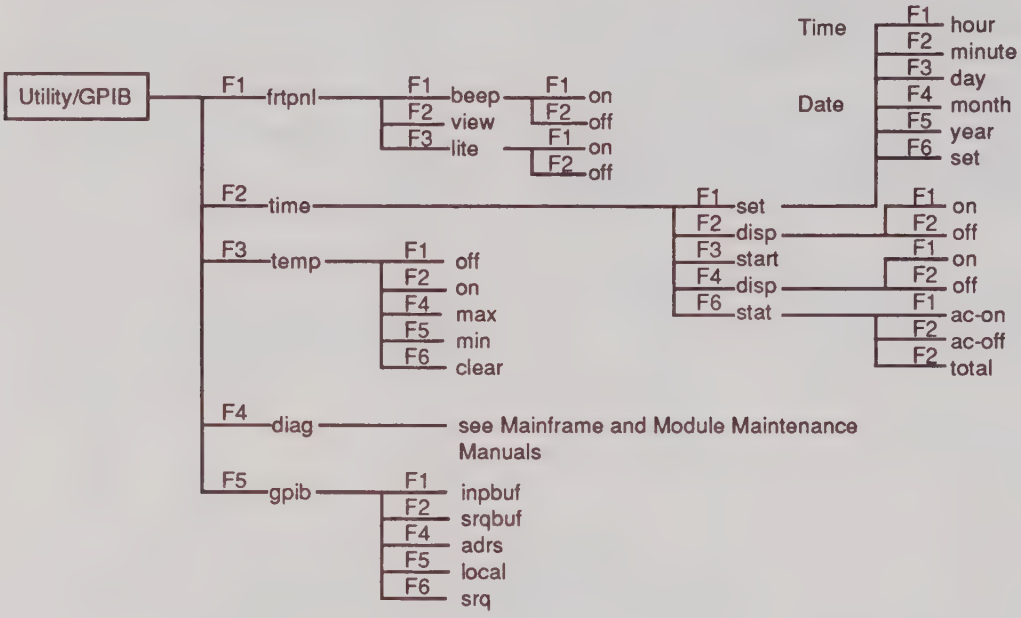


Figure 3-7. The Utility GPIB Menu Tree

Table 3-9. Utility/GPIB Time Utilities

Top Level	Second Level	Third Level	Description
F2 time			This key selects the time utilities menu.
	F1 set		This key allows the user to set the correct time of day and the correct calendar date. Use the function and cursor keys as described below to make the entries.
		F1 hour	Press this key and then use the front panel knob or cursor controls to enter the current hour.
		F2 minute	Press this key and then use the front panel knob or cursor controls to enter the current minute.
		F3 day	Press this key and then use the front panel knob or cursor controls to enter the current day.
		F4 month	Press this key and then use the front panel knob or cursor controls to enter the current month.
		F5 year	Press this key and then use the front panel knob or cursor controls to enter the current year.
		F6 set	After entering desired choices for the current time and date, press this key to change the current time and date to the values just entered using the F1 through F5 keys above.

Table 3-9. Utility/GPIB Time Utilities (Continued)

Top Level	Second Level	Third Level	Description
	F2 disp		Allows selection of whether or not the current time and date are continuously displayed on the LCD display. The function keys F1 and F2 are used to make this selection as described below.
		F1 on	Turns on the display of the current time and date.
		F2 off	Turns off the display of the current time and date.
	F3 start		Immediately clears the contents of the elapsed time counter and immediately starts it running. The resolution of the elapsed time counter is 1 second and the range is 999 days.
	F4 disp		Allows selection of whether or not the elapsed time and date are continuously displayed on the LCD display. The function keys **F1** and **F2** are used to make this selection as described below.
		F1 on	Turns the display of the elapsed time on.
		F2 off	Turns the display of the elapsed time off.
	F6 stat		Selects the time statistics controls described below.
		F1 ac-on	Displays the amount of time elapsed since the 680 was last turned from Standby to On.
		F2 ac-off	Displays the total time the 680 has been turned off.
		F3 total	Displays the total time elapsed since the time was last set by the user.

3.4.3 Temperature Logging Functions

The 680 always monitors its internal temperature and will generate a warning when the internal temperature reaches 50C. The utilities menu can be used to select for display the internal cabinet temperature, the maximum temperature excursion, and the minimum temperature excursion. A selection in this menu also allows clearing the maximum and minimum temperature record so that new minimum and maximum values can be stored from the time the clear selection is made.

Table 3-10 shows how the function keys F1 through F6 are defined to control the temperature logging functions.

Selections from this menu can be made by pressing the Utility/GPIB and Temp keys on the front panel.

3.4.4 Front Panel GPIB Controls

This section of the Utility/GPIB menu allows control of the GPIB features. This menu allows:

1. Display of the GPIB input buffer contents.
2. Display of the GPIB service request buffer contents.
3. Display and control of the 680 GPIB address.
4. Return of the 680 to local operation.
5. Generation of a Service Request over the GPIB.

Table 3-11 shows the assignment of the function keys F1 through F6 when the GPIB section of the Utility/GPIB menu is called.

To enter this menu, press the **System** Utility/GPIB key and then proceed to the beginning of table 3-11.

Table 3-10. Utility/GPIB Temperature Utilities

Top Level	Second Level	Third Level	Description
F3 temp			Selects the temperature utilities menu. Use the function keys as detailed below to have the 680 log and/or display its minimum and maximum internal temperatures.
	F1 on		Turns on the display of the 680 internal temperature.
	F2 off		Turns off the display of the 680 internal temperature.
	F4 max		Displays the maximum internal temperature excursion.
	F5 min		Displays the minimum internal temperature excursion.
	F6 clear		Clears the min and max temperature records so that the recording process can be started over.

Table 3-11. Front Panel GPIB Controls

Top Level	Second Level	Third Level	Description
F5 GPIB			Selects the front panel GPIB controls. The second level selections under this heading appear below.
	F1 inpbuf		Displays the contents of the input buffer, including the special control characters <CR>, <LF>, and <EOI>. Rotation of the cursor knob allows the entire contents of the GPIB buffer to be scrolled across the display.
	F2 srqbuf		Displays the entire contents of the service request buffer. Rotation of the cursor knob allows the entire contents of the service request buffer be scrolled across the display. The service request buffer contains a log of all GPIB service requests. Each time a service request is generated, an entry is made to this buffer; reading this buffer over the GPIB clears this buffer.
	F4 adrs		Displays the currently selected GPIB address. At power up this is the rear panel GPIB address switch setting.
	F5 local		Returns the unit to the local condition if it was in remote and if local lockout was not enabled.
	F6 srq		Generates a service request if the service request mask is set to enable service requests from the front panel.

3.5 System Cal/Test Key

The **System** Cal/Test key provides system and function module calibration and self-test. The system wide calibration is performed by sending the appropriate calibration or self-test command to each module in succession, starting with the system module (module 0) and continuing with module 1 through module 8. When the complete series of module commands are finished, the global calibration or self-test ends with a global summary display for that function on the front panel display.

Figure 3-8 shows the Cal/Test menu tree. Use this tree in conjunction with table 3-12 which describes the operation of the function keys F1 through F6 when identified by the Cal/Test menu.

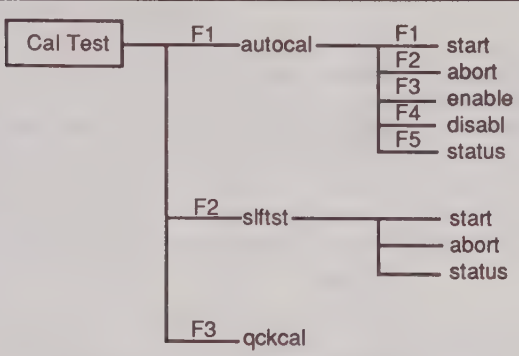


Figure 3-8. The Cal/Test Menu Tree

Table 3-12. Cal/Test Controls

Top Level	Second Level	Third Level	Description
F1 autocal			This key allows selections for the system or global wide auto calibration procedure as described below.
	F1 start		Starts the auto cal process. The calibration of all the installed function modules takes place in order. During auto calibration, the second line of the display will indicate the parameter under test.
	F2 abort		Aborts the auto cal process at the completion of the current auto cal step. Data base for completed modules will be retained, others will keep old data.
	F3 enable		Activates the auto cal data base if it has been previously disabled.
	F4 disabl		Deactivates the auto cal data base and substitutes nominal values from memory as if the 680 had been powered up for the very first time and no auto cal had ever been performed. This is useful for cases in troubleshooting where the auto cal process has brought a faulty circuit almost within limits. By disabling the the auto cal data base, it can be seen if a particular circuit is out of range of the auto cal function.
	F5 status		Displays the last completed Global Autocal status along with the date and time of completion. (See section 3.12).
F2 slftst			Pushing this key allows selection of the self test of the 680 System Mainframe and all installed function modules. Use the keys as described in the second levels that follow.

Table 3-12. Cal/Test Controls (Continued)

Top Level	Second Level	Third Level	Description
	F1 start		Initiates the selftest of the entire 680 System Mainframe and all installed function modules. When the complete test is finished, the front panel display will display which modules, if any failed the test and if all modules passed the test.
	F2 abort		Aborts the self test process and returns the 680 to the top of this menu.
	F3 status		Displays the status of the last completed self test. See Section 3.11.
F3 qckcal			This calibration holds tolerance only for the current settings; if any of the settings are changed, that setting reverts to the autocal. (Only on implemented modules such as Tgen.)

3.6 Stored Setting Menu Key

This feature saves (remembers) the settings of an individual module or the entire 680 System Mainframe. These settings are saved even when the 680 is turned off; when the 680 is turned back on, the saved setting(s) can be recalled.

Three types of settings can be saved:

1. All of the settings for a particular module.
2. All of the settings for the 680 system excluding function modules.
3. All function module and system settings.

Saving the settings for the entire system requires 9 assignment numbers of an available 99; saving the settings of just a particular function module or just the 680 system alone requires 1 assignment number for each setting saved.

The 680 will display a limit error when there is not enough memory left to complete a stored setting operation.

Figure 3-9 shows the Stored Setting menu tree; use the tree in conjunction with table 3-12 to use the Stored Setting features. Table 3-13 shows how the function keys F1 through F6 are defined when the Stored Setting menu is called.

To enter this menu, press the **System** Stored Setting key and then proceed to the beginning of table 3-13.

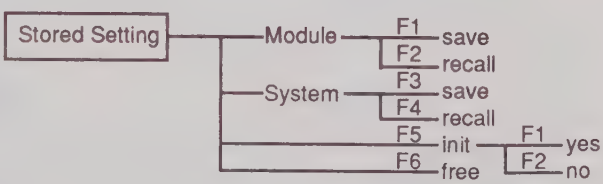


Figure 3-9. The System Stored Setting Menu Tree

Table 3-13. Stored Settings Controls

Top Level	Second Level	Third Level	Description
F1 save (module)			Stores all parameter settings for a currently selected module. To save the settings for a particular module, press this key and then assign a number for the setting via the keyboard. Press execute The setting for the selected module is now saved; the display willindicate the number assigned to the setting just saved. Enteringa minus sign before a value removes the setting previously assigned to that value.

Table 3-13. Stored Settings Controls (Continued)

Top Level	Second Level	Third Level	Description
F2 recall * (module)			Recalls all parameter settings for a currently selected module. To recallthe settings for a particular module, press this key and then enter the number for the setting to be recalled via the keyboard. Press Execute. The setting for the selected module is now recalled; the display will indicate the number assigned to the setting just recalled.
F3 save (system)			Stores all parameter settings for all modules and chassis in the 680. To save the settings for a the 680, press this key and then assign a number for the settings via the keyboard. Press Execute. The setting for the 680 is now saved; the display will indicate the number assigned to the setting just saved. Entering a minus sign before a value removes the setting previously as signed to that value.
F4 recall * (system)			Recalls all parameter settings for a the 680. To recall the settings for the 680, press this key and then enter the number for the setting to be recalled via the keyboard. Press Execute. The setting for the 680 system is now recalled; the display will indicate the number assigned to the setting just recalled.
F5 init			Pressing this key brings up a menu to erase all stored settings in the 680. To prevent unwanted (accidental) erasures of the stored settings, the user is prompted by the display to press the yes or no function keys as follows.
	F1 yes		Press this key in response to the display message "Init memory: are you sure?" if complete deletion of all the stored settings is desired.
	F2 no		Press this key in response to the display message "Init memory: are you sure?" if complete deletion of all the stored settings is not desired.
F6 free			Causes the display to indicate the number of free assignments left for designation of stored settings.

* Caution: Once a setting has been stored (either module or system) you cannot rearrange the modules and then recall a stored setting. The stored settings apply only to a consistantly configured 680.

3.7 MANUAL TRIGGER KEY

Pressing this key will assert the System Trigger (STRIG) line on the 680 System Mainframe. Any modules configured to respond to the System Trigger (STRIG) signal will do so when this key is pressed.

3.8 SYSTEM RESET KEY

The System Reset key:

1. Can bring the entire 680 to the power-up state as if powered up for the first time by asserting a hardware reset to all processors in the 680 or,
2. Cause a software reset in the 680 to bring all modules to the power-up condition.

Figure 3-10 shows the System Reset menu tree. Use the menu tree in conjunction with table 3-14 which shows how the function keys F1 and F2 are defined by the System Reset menu.

3.9 OPERATING THE 680 FROM THE GPIB

The IEEE-488 General Purpose Interface Bus interface for the Model 680 uses a single connector and interface for al of the instrument modules in the chassis. A single primary address is used for the entire 680 system. The individual modules use a secondary address (as per IEEE-488 standard) for commands to each individual

Table 3-14. System Reset Controls

Top Level	Second Level	Third Level	Description
F1 soft			Press this key to allow selection of the software reset. Use the F1 softkey at the second level as described next to initiate the software reset. Also resets the output protection of any module that has tripped off due to overload conditions.
	F1 yes		Press this key to initiate the software reset.
	F2 cancel		Press this key to cancel the software reset.
F2 hard			Press this key to allow selection of the hardware reset. The hardware reset brings the entire 680 to the powerup condition; the front panel displays the powerup message "Wavetek Model 680 Version X.X". Use the F1 softkey at the second level as described next to initiate the hardware reset.
	F1 yes		Press this key to initiate the hardware reset.
	F2 cancel		Press this key to cancel the hardware reset.

module. The secondary addresses are 0 through 9. The Model 680 system chassis commands are in module 0. The plug in modules are in modules 1 through 8, with modules being numbered by their physical order in the chassis, module 1 being closest to the Ref/Cal board and module 8 being closest to the power supply. Module 9 is a virtual module containing the global commands that broadcast to all modules.

The chassis' primary address can be set by either the DIP switch on the rear panel or by programming the address on the 680 front panel. The DIP switch has eight switches, five of which are used for setting the GPIB primary address. One is the Mate Enable for Mate units and the last one is the front panel enable. The primary address can only be programmed from the front panel if this switch is enabled. See Section 2.6.3.

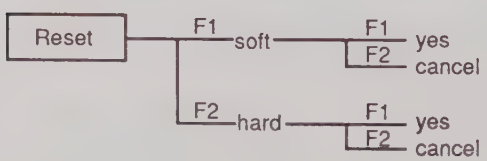


Figure 3-10. System Reset Menu Tree

3.9.1 GPIB Compliance Requirements

The 680 GPIB interface meets the following compliance criteria to the IEEE-488.1 standard:

Source Handshake: SH1
Acceptor Handshake: AH1
Talker: TE6
Listener: LE4
Service Request: SR1
Remote/Local: RL1
Parallel Poll: PPO
Device Clear: DC1
Device Trigger: DT1
Electrical: E1

The 680's GPIB software interface uses a subset of the IEEE-488.2 Standard, "Codes, Formats, Protocols and Common Commands For Use With ANSI/IEEE Std 488.1 — 198x, IEEE Standard Digital Interface for Programmable Instrumentation."

Note

The second switch from the top of the rear panel switch ADDRESS SELECTOR selects the line terminator for the standard 680. For the 680 MATE, it enables/disables MATE. The terminator is different for enable and disable.

Standard 680:

		Terminator
0	=	*LF/EOI*
1	=	*CR/LF*

680 MATE:

		Mate	***Terminator***
0	=	*Disabled,*	*LF/EOI*
1	=	*Enabled,*	*CR/LF*

Talk messages are terminated with a LF/EOI. Listen messages are terminated as per IEEE-488.2. Carriage Returns are treated as white space.

3.9.2 GPIB Command Definitions

The 680 uses three kinds of GPIB commands:

1.680 chassis specific commands.

2.Common commands.

3.Instrument module specific commands.

Table 3-15 lists the 680 chassis commands; table 3-16 lists all common commands. Instrument module specific commands can be found in the function module appendices.

Table 3-15. 680 Chassis Specific Commands

COMMAND	RANGE / STRING	FUNCTION
Notes: All of these commands are sent to secondary address '0' or mainframe.		
Commands-> Uppercase characters are mandatory		
Lowercase characters are optional and		
Underscore is optional (for readability)		
For the value of a parameter, the string or numeric equivalant may be sent.		
Numbers used in command strings and on queries are either floating point(f) or integer(n) as noted.		
<ascii string> means an ascii string message will be returned in these cases.		
SYSTEM		
TRIGger_Input	0 to 4 (default = 4)	Selects system trigger mode/source
INTernal	0	Selects internal trigger generator
Ext_Normal	1	Selects external trigger source
Ext_Events	2	Selects divided external trigger
Ext_Delayed	3	Selects delayed external trigger
OFF	4	Disables system trigger source
TRIGger_Input?	TRIGGERINPUT n	Returns selected trigger source
Trig_Delay_Time	100E-9 to 100 (default 100e-9)	External system trigger delay time
Trig_Delay_Time?	TRIGDELAYTIME f	Returns external trigger delay time
Trigger_eVents	2 to 1E7 (default = 2)	Event delayed ext trig number
Trigger_eVents?	TRIGGEREVENTS f	Returns event delayed ext trig number
Trigger_FReq	1E-2 to 1E7 (default = 10e3)	Sets internal trigger frequency
Trigger_FReq?	TRIGGERFREQ f	Returns internal trigger frequency
Trigger_LeVeL	-10 to 10 (default = 1.6)	Sets response level to ext trigger
Trigger_LeVeL?	TRIGGERLEVEL n	Returns trigger response level
Trigger_SLoPe	0 to 1 (default = 0)	Selects response slope of ext trig
Positive	0	Respond to positive exttrig slope
Negative	1	Respond to negative exttrig slope
Trigger_SLoPe?	TRIGGERSLOPE n	Returns selected trigger slope
*TRG	----------	Triggers waveforms
SsYNC	0 to 1 (default = 0)	Selects system sync mode
Independent	0	Selects independent system sync
Slave	1	Selects Slave system sync mode
SsYNC?	SSYNC n	Returns system sync mode

Table 3-15. 680 Chassis Specific Commands (Continued)

COMMAND	RANGE / STRING	FUNCTION
REFerence	0 to 1 (default = 0)	Select 10 MHz reference source
INTernal	0	Selects internal 10MHz reference
EXTernal	1	Selects external 10MHz reference
REFerence?	REFERENCE n	Returns 10 MHz reference source
STORED SETTING		
*SAV	1 to 99	Stores mainframe setup
*SAV	-1 to -99	Deletes a stored mainframe setup
*RCL	1 to 99	Recalls specified mainframe stored setting
UTILITY		
BeeP	0 to 1 (default = 1)	Sets beep on/off for front panel keys
OFF	0	Turns beep tone off
ON	1	Turns beep tone on
Viewing_Angle	0 to 45 (default = 0)	Sets viewing angle of display
Viewing_Angle?	VIEWINGANGLE n	Returns viewing angle of display
BackLight	0 to 1 (default = 1)	Controls display backlight
OFF	0	Turns display backlight off
ON	1	Turns display backlight on
CAL/TEST		
*CAL?	n	Starts auto calibration & returns status
@CAS?	n	Returns status of last autocal
AutoCAL_Disable	----------	Disables mainframe autocal corrections
AutoCAL_Enable	----------	Enables mainframe autocal corrections
*TST?	n	Starts selftest & returns status
@STS?	n	Returns status of last selftest
MISC/GPIB		
*RST	----------	Resets all parameters to default conditions
RTM	----------	Return to MATE, if CIIL compatible & enabled Needs delay of 200 msec. before a MATE command may be sent after this. This returns all modules in chassis to CIIL syntax.
EXECute	----------	Executes a command string
Front_Panel	0 to 1 (default = 1)	Controls access to front panel
OFF	0	Turns front panel off
ON	1	Turns front panel on
*IDN?	WAVETEK,680,0,Vn.n.n	Returns Mainframe identification and software version(Vn.n.n)
*OPC	----------	Will set operation complete bit of ESR

Table 3-15. 680 Chassis Specific Commands (Continued)

COMMAND	RANGE / STRING	FUNCTION
*CLS	----------	Clears event status register
*ESE	0 to 255 (default = 0)	Sets event status enable mask
*ESE?	n	Returns event status enable mask
*ESR?	n	Returns event status register value
*SRE	0 to 255 (default = 0)	Sets service request enable mask
*SRE?	n	Returns service request enable mask
*STB?	n	Returns service request status byte
*TRG	----------	Trigger command to mainframe
*WAI	----------	Wait-to-continue command
@CME?	<ascii string>	Query for command error message
@EXE?	<ascii string>	Query for execute error message
@QYE?	<ascii string>	Query for query error message
@DDE?	<ascii string>	Query for device dependent error message

Notes: All of these commands will be sent to secondary address '9' for global events.
For CAL and TST, the commands are internally sent to each module installed including mainframe.
SAV and RCL save or recall stored setting for all installed modules at one time.
Commands-> Uppercase characters are mandatory.
<ascii string> means an ASCII string message will be returned in these cases.

STORED SETTING		
*SAV	1 to 9	Stores global setup
*SAV	–1 to –9	Deletes a stored setup
*RCL	1 to 9	Recalls specified stored setup
CAL TEST		
*CAL?	n	Start global autocal & return status
@CAS?	n	Returns status of last autocal
AutoCAL_Disable	----------	Disables global autocal corrections
AutoCAL_Enable	----------	Enables global autocal corrections
*TST	n	Starts selftest & returns status
@STS?	n	Returns status of last selftest
MISC/GPIB		
*RST	----------	Resets all parameters to default conditions
*IDN?	WAVETEK,680,0,Vn.n.n	Returns Mainframe identification and software version (Vn.n.n)
*OPC	----------	Will set operation complete bit of ESR
*CLS	----------	Clears event status register
*ESE	0 to 255 (default = 0)	Set event status enable mask

Table 3-15. 680 Chassis Specific Commands (Continued)

COMMAND	RANGE / STRING	FUNCTION
*ESE?	n	Returns event status enable mask
*ESR?	n	Returns event status register value
*SRE	0 to 255 (default = 0)	Sets service request enable mask
*SRE?	n	Returns service request enable mask
*STB?	n	Returns service request status byte
*TRG	----------	Initiates trigger on STRIG bus
*WAI	----------	Wait-to-continue command
@CME?	<ascii string>	Query for command error message
@EXE?	<ascii string>	Query for execute error message
@QYE?	<ascii string>	Query for query error message
@DDE?	<ascii string>	Query for device dependent error message

Manufacturers of function modules other than Wavetek do not necessarily conform to the IEEE-488.2 protocalls and may have command sets that are not compatible with the common commands described here. Check the manufacturers programming guide for further information.

Table 3-16 describes those 680 common commands that do not conform to the IEEE-488.2 definition. All of these common commands are identified with the "' prefix in their command string.

Table 3-16. Nonstandard 680 Common Commands

Command String	Command Name
@CME?	Command Error Query
@EXE?	Execution Error Query
@DDE?	Device Dependent Error Query
@QYE?	Query Error Query
@STS?	Report status of last self test, without invoking a new self test
@CAS?	Report status of last auto-cal, without invoking a new auto-cal

3.9.3 GPIB Error Handling and Status Reporting

Errors and status in the 680 are handled as described for Device Status Reporting consistent with the IEEE-488.2 standard in Chapter 11. Errors and status may be monitored by reading the IEEE-488.1 Status Register, either by serial polling the 680 or by sending a Status Byte read command (*STB?) to the 680. Each module has its own Status Byte associated with its own secondary address. The serial poll or the *STB? query have to be done to the module's primary and secondary address.

Three bits in the Status Byte are defined as follows:

- Bit 6 (DIO7): RQS/MSS

  RQS/MSS acts as a summary bit for the rest of the Status Byte bits. If any of the other Status Byte bits are asserted along with their corresponding mask bits in the Service Request Enable Register, then the RQS/MSS bit will be asserted. This allows the controller to test for the RQS/MSS bit for selected information (selected by the mask bits in the Service Request Enable Register) automatically without having to mask and test the Status Byte manually.

  RQS is in response to a serial poll and is partially defined in the IEEE-488.1 spec. and further defined in the IEEE-488.2 spec. RQS will be true during a serial poll if the 680 has an SRQ true condition pending.

  MSS is in response to a *STB? query and is defined in the IEEE-488.2 spec. MSS will be true if the logical AND of the Status Byte bits and a mask byte, the Service Request Enable Register yields a true result in any bit location (except bit 6 of course). The only bits used in the 680 are bit 4 (DIO5) and bit 5 (DIO6) mentioned below.

- Bit 5 (DIO6): ESB

  Standard Event Status Bit Summary Message. This is a summary message bit for the Standard Event Status Register.

- Bit 4 (DIO5): MAV

  Message Available Queue summary bit. This bit is always true if another byte is available to be output to the controller. When the queue is empty, the MAV bit is cleared.

The remaining bits in the 680 Status Byte have no effect.

The ESB bit is a summary bit for another status register, called the Standard Event Status register, which is used to extend the types of status information available to the controller from the instrument's status functions. The IEEE-488-2 document defines all eight bits for particular functions. The 680 only uses a subset of these. They are as follows:

- Bit 7: Not Used (Power On)
- Bit 6: Not Used (User Request)
- Bit 5: Command Error

  Set to true whenever a syntax error is encountered in the command string to the 680.
- Bit 4: Execution Error

  Set whenever a parameter exceeds the range available for that parameter, except for inter-parameter conflict errors which are handled by bit 3.
- Bit 3: Device Dependent Error

  Set whenever the instrument module encounters an error specifically associated with the operation of that type of module. This includes inter-parameter conflict errors.
- Bit 2: Query Error

  Set whenever a query is made to the 680 for which no response is available.
- Bit 1: Not Used (Request Control)
- Bit 0: Operation Complete

  Set whenever the last command has finished execution and the 680 is ready to accept another command or the results from the last query are available.

This register, along with a mask enable register called the Standard Event Status Enable Register, is used to set the ESB bit in the Status Byte of the 680 GPIB inter-face. The Standard Event Status Register (ESR) is bit-wise logically ANDed with the Standard Event Status Enable Register (ESE) to generate the ESB bit. If any of the bits in the ESR are true along with the corresponding bits in the mask ESE, then the Event Status summary Bit (ESB, bit 6) in the GPIB Status Byte will be asserted. This way the Status Byte can be serial polled to see if any one of the conditions in the ESR has occurred.

3.10 ERROR AND EVENT Messages

This section classifies errors and events and describes how the 680 responds to them.

3.10.1 Limit Errors

A limit error when a parameter is programmed beyond its allowable limits. For example, if an attempt is made to set an output amplitude to 1000V when the maximum allowable amplitude is 32V, line two of the display will show an out of limit message.

3.10.2 Executable Conflict Errors

A conflict error occurs when two or more parameters are within their respective allowable limits but are invalid when programmed simultaneously. Setting an output amplitude and offset in such a way as to cause waveform distortion will cause a conflict error message to appear on line 2 of the display.

3.10.3 Data Errors

Data errors relate to loss of internal memory. An example would be an error detected when an attempt is made to recall a stored setting.

3.10.4 Hardware Error

Hardware errors occur when a hardware failure condition either occurs spontaneously (like output protection) or is detected as a result of programming (like quick cal failure). As these errors occur, the appropriate message occurs on the display.

3.10.5 Non-executable Conflict Errors

These errors are similar to the conflict errors in Section 3.10.2 but involve parameter settings which make no sense or which may cause unpredictable results on the output which could damage a test device connected to the output of the instrument. Errors of this type do not execute the command.

3.11 SYSTEM SELF TEST (secondary address 0)

Once started, the system self test takes about 6 seconds to complete. Most of this time is spent waiting for the internal trigger frequency to settle before measuring it with the counter on the ref/cal board.

The error code returned from the system self test is the sum of the individual error codes for each signal tested, and will either be zero if all tests have passed or a decimal number representing the failed test(s).

Error Code	Test1	Test2	Test3	Test4	Test5
Pass	0	0	0	0	0
Fail	1	2	4	8	16

For example, an error code of "3" would indicate that tests 1 and 2 had failed.

The Model 680 system self test is composed of five subtests. Four of these tests check signal paths and components using an onboard counter. One test uses the onboard DVM.

Test 1

Signal tested	Tolerance	Error	Description
10 MHz clock	0.005%	1	System reference clock

This test measures the frequency of the 10 MHz system reference clock (U14). Since this same signal is used as the frequency reference for the counter being used to test it, we do this test only to verify the signal path and operation of the counter circuitry.

The circuits tested are:

U14 System Reference Clock	(MONITOR 7400 B 10.0000 MHz)
U32 Frequency source selector	(74ALS151)
U33 Counter	(ST5152)

Test 2

Signal tested	Tolerance	Error	Description
10 MHz oscillator	7%	2	Synchronous oscillator gateable

This test measures the frequency of the 10 MHz synchronous gateable oscillator circuit using the onboard counter to a tolerance of 7%.
The circuits tested are:

U17 Dual comparator	(NE521)
U32 Frequency source selector	(74ALS151)

Test 3

Signal tested	Tolerance	Error	Description
175 kHz oscillator	5%	4	DVM intergration oscillator

This test measures the frequency of the 175 kHz DVM oscillator circuit using the onboard counter to a tolerance of 5%.

The circuits tested are:

U36 DVM oscillator section	(ICL7109)
U32 Frequency source selector	(74ALS151)

Test 4

Signal tested	Tolerance	Error	Description
Internal trigger	0.1%	8	System trigger reference

This test measures several frequencies derived from the 10 MHz clock by the internal trigger circuitry using the onboard counter to a tolerance of 0.1%. The frequencies 10Hz, 100 Hz and 1 kHz are measured by the onboard counter using period average mode. The frequencies 10 kHz, 100 kHz, 1 MHz and 10 MHz are measured by the onboard counter using gated mode wiith a gate time of 100 ms.

The circuits tested are:

U23 Trigger source selector	(74ALS151)
U19 Dual D flip-flop	(74LS74)
U21 Programmable phase detector	(MC145155)
Op Amp	(TL082)
Trigger source selector	(74ALS151)
Voltage controlled oscillator	(64LS624)
Programmable Frequency Divider	(74LS292)
Frequency source selector	(74ALS151)

Test 5

Signal tested	Tolerance	Error	Description
Temperature	15-35°C	16	System Temperature reference

The DVM is set up to monitor the temperature near the rear of the Reference/Calibration Board by measuring the voltage from an LM35DZ tmperature sensor. A measurement in the range of 15 to 35 degrees Celsius gives a rough indication that the DVM chip is working.

The circuits tested are:

U35 DVM input selector	(DG508)
U36 DVM	(ICL7109)
CR9 Temperature sensor	(LM35DZ)

3.12 GLOBAL AUTOCAL STATUS

Three hexadecimal digits are used to represent which module or channel number had a failure when a selftest or autocal is carried out. This is illustrated in figure 3-11.

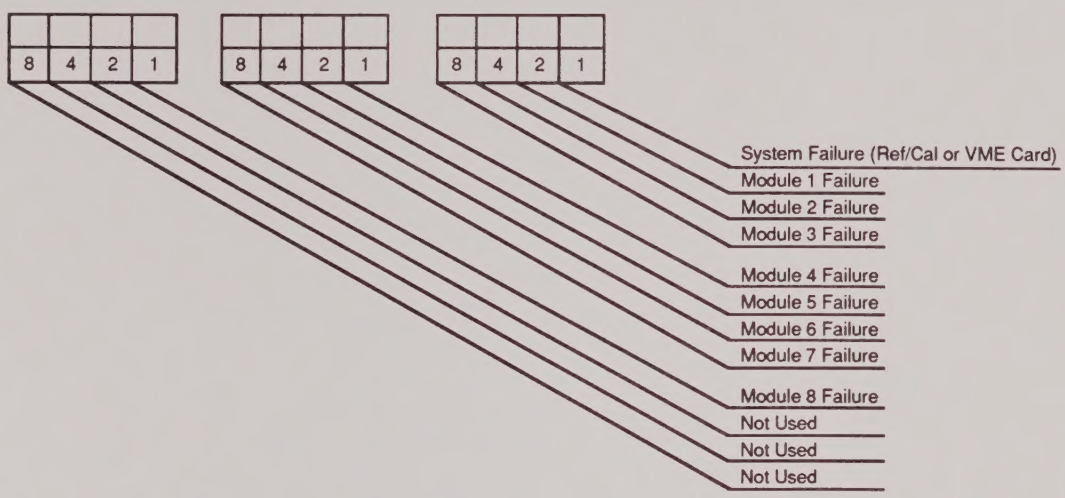


Figure 3-11. Global Autocal

MP MASTER
MA35695